M. BLVNDEVILE

His Exerciſes, containing eight Treatiſes, the titles whereof are ſet downe *in the next printed page: which Treatiſes are verie* neceſſarie to be read and learned of all young Gentlemen, *that haue not beene exerciſed in ſuch diſciplines*: and yet are deſirous to haue knowledge as well in Coſmographie, *Aſtronomie, and Geographie, as alſo in the* Arte of Nauigation, in which Arte it is impoſſible to profite without the helpe of theſe, or ſuch like inſtructions.

To the furtherance of which Arte of Nauigation, the ſaid *M.* Blundeuile *ſpecially wrote the ſaid Treatiſes, and of meere* goodwill doth Dedicate the ſame to all young Gentlemen of this Realme.

The third edition.



Imprinted at London by *Iohn Windet*, dwelling at the ſigne of the Croſſe Keyes, neere Paules Wharffe,
1606.


BRITISH MUSEUM

The Titles of the Treatiſes contained in this Booke.

FIrſt, a very eaſie Arithmeticke, ſo plainely written as any man of a meane capacitie may eaſily learne the ſame, without the help of any teacher.

Item the firſt principles of Coſmographie, and eſpecially a plaine treatiſe of the Spheare, repreſenting the ſhape of the whole world, together with the chiefeſt and moſt neceſſarie vſes of the ſaid Spheare.

Item a plaine and full deſcription of both the Globes, as well Terreſtriall as Celeſtiall, and all the chiefeſt and moſt neceſſarie vſes of the ſame, in the ende whereof are ſet downe the chiefeſt vſes of the Ephemerides of *Iohannes Stadius*, and of certaine neceſſarie Tables therein contained for the better finding out of the true place of the Sunne and Moone, and of all the reſt of the Planets vpon the Celeſtiall Globe.

Item a plaine and full deſcription of *Petrus Plancius* his vniuerſall Mappe, lately ſet foorth in the yeare of our Lord 1592. containing more places newly found, as well in the Eaſt and Weſt Indies, as alſo towards the North Pole, which no other Mappe made heretofore hath, whereunto

is alſo added how to finde out the true diſtance betwixt any two places on the land or ſea, their Longitudes and latitudes being firſt knowne, and thereby you may correct the skales or Tronkes, that be not truely ſet downe in any Map or Carde.

Item, A briefe and plaine deſcription of M. *Blagraue* his Aſtrolabe, otherwiſe called the Mathematicall Iewell, ſhewing the moſt neceſſary vſes thereof, and meeteſt for ſea men to know.

Item the firſt & chiefeſt principles of Nauigation more plainely and more orderly taught then they haue beene heretofore by ſome that haue written thereof, lately collected out of the beſt modern writers, and treaters of that Arte.

Item a briefe deſcription of vniuerſall Maps & Cardes, and of their vſe: And alſo the vſe of *Ptolomie* his Tables together with the true order of making the ſaid Tables. And of all other Maps and Cardes as well vniuerſall as particular, and that according to the doctrine of the beſt Geographers, that be, or haue beene in theſe latter daies.

Item the true order of making of *Ptolomie* his Tables and alſo the making of all other Tables, Maps or Cardes, as well vniuerſall as particular, and that according to the doctrine of the beſt Geographers that be or haue beene in theſe later daies.

And moreouer, I haue thought good to adde vnto mine Arithmeticke, as an appendix depending thereon, the vſe of the Tables of the three right lines belonging to a Circle, which lines are called Sines, lines Tangent, and lines Secant,

cant, whereby many profitable and neceſſarie concluſions as well of Aſtronomie, as of Geometrie are to be wrought onely by the helpe of Arithmeticke, which Tables are ſet downe by *Clauius* the Ieſuite, a moſt excellent Mathematician, in his Booke of demonſtrations made vpon the Spherickes of *Theodoſius*, more truely printed than thoſe of *Monte Regio*, which booke whileſt I read at mine owne houſe, together with a louing friend of mine, I took ſuch delight therein, as I mind (God willing) if God giue me life, to tranſlate all thoſe propoſitions, which *Clauius* himſelfe hath ſet downe of his owne, touching the quantitie of Angles, and of their ſides, as well in right line triangles, as in Spherical triangles: of which matter, as *Monte Regio* wrote diffuſedly and at large, ſo *Copernicus* wrote of the ſame briefly, but therewith ſomewhat obſcurely, as *Clauius* ſaith. Moreouer, in reading the Geometrie of *Albertus Durerus*, that excellent painter, and finding many of his concluſions very obſcurely interpreted by his Latine interpreter (for he himſelfe wrote in high Dutch) I requeſted a friend of mine, whom I knew to haue ſpent ſome time in the ſtudy of the Mathematicals, not onely plainely to tranſlate the foreſaid *Durerus* into Engliſh, but alſo to adde thereunto many neceſſarie propoſitions of his owne, which my requeſt he hath (I thanke him) very well perfourmed, not onely to my ſatisfaction, but alſo to the great commoditie and profit of all thoſe that deſire to be perfect in Architecture, in the Arte of Painting, in free Maſons craft, in Ioyners craft, in Caruers craft, or any ſuch like Arte commodious and ſeruiceable in any common Wealth, and I hope that he will put the ſame in Print ere it be long, his name I conceale at his owne earneſt intreatie, although much againſt my will, but I hope that he

will make himſelfe knowne in the publiſhing of his Arithmeticke, and the great Arte of *Algebra*, the one being almoſt finiſhed, & the other to be vndertaken at his beſt leaſure, as alſo in the Printing of *Durerus*, vnto whom he hath added many neceſſarie Geometricall concluſions, not heard of heeretofore, together with diuerſe other of his works as well in Geometrie, as in other of the Mathematicall ſciences, if he be not called away from theſe his ſtudies by other affaires. In the meane time I pray all young Gentlemen and ſea-men to take theſe my labours alreadie ended in good part, whereby I ſeeke neither praiſe nor glory, but onely to profit my countrey.

To

To the Reader.

I *Greatly reioyce to see so many of our English Gentlemẽ, both of the Court & Countrie in these dayes so earnestly giuẽ to trauell as well by sea as land, into strange and vnknowne countries: & specially into the East & West Indies, following therein the good example of diuers worthy knights & Gentlemẽ, that haue ventured their liues to discouer strange countries to the great honour of their countrie, and to their owne immortall fame. And because that to trauell by sea requireth skill in the Art of Nauigation, in which it is vnpossible for any man to be perfect vnlesse he first haue his Arithmeticke, and also some knoweledge in the principles of Cosmographie, & specially to haue the vse of the Spheare, of the two Globes, of the Astrolabe, and crosse staffe, and such like instruments belonging to the Art of Nauigation, I thought good therefore to write the Treatises before mentioned, to serue as an introduction for such young Gentlemen as haue not beene exercised in such kind of studies, which Treatises if they shall vouchsafe to reade with attentiue minde, and in such order as they are before set downe, I doubt not but that it will cause them hereafter to seeke for further knowledge therein. And in anywise I wish them to begin with my Arithmeticke, the contents whereof are declared in the next Chapter following. In the meane time I doe earnestly request all young Gentlemen to take these my simple pamphlets no lesse thankfully than they haue done my horse booke, and in so doing I shall haue iust cause to thinke my labour well bestowed.*

What

The Preface

What cause first moued the Author to write this Arithmeticke, and with what order it is heere taught, which order the contents of the chapters thereof hereafter following doe plainely shew.

I Began this Arithmetike more than seuen yeares since for a vertuous Gentlewoman, and my verie deare friend M. Elizabeth Bacō, the daughter of Sir Nicholas Bacon Knight, a man of most excellent wit, and of most deepe iudgement, and sometime Lord keeper of the great seale of England, and lately (as she hath beene many yeares past) the most louing and faithfull wife of my worshipfull friend M. Iustice Windham, not long since deceased, who for his integri ty of life, and for his wisedome and iustice daylie shewed in gouernment, and also for his good hospitalitie deserued great commendation. And though at her request I had made this Arithmeticke so playne and easie as was possible (to my seeming) yet her continuall sickenesse woulde not suffer her to exercise her selfe therein. And because that diuers hauing seene it, and liking my plaine order of teaching therein, were desirous to haue Copies thereof, I thought good therefore to print the same, and to augment it with many necessarie rules meete for those that are desirous to studie any part of Cosmographie, Astronomie, or Geographie, and speciallie the Arte of Nauigation, in which without Arithmeticke, as I haue said before, they shall hardly profite. But now to returne to my mat-

matter, the contents of this Arithmeticke are these here following. First, hauing defined what Arithmeticke is, and what numeration or numbering is, and of what parts it consisteth, and how to number any great summe written in many figures, I deale with the foure speciall kindes of Arithmetike, that is, Addition, Subtraction, Multiplication and Diuision. Then I shew the order of working in whole numbers, called in Latine Integra, by the rule of proportion, otherwise called the golden rule, or the rule of three: Then I treate of broken numbers called Fractions, setting downe seuen necessarie rules belonging thereunto, by the helpe whereof you shall be the better able to adde, subtract, to multiplie, & diuide the same. That done, I shew how to vse the rule of three, as wel in dealing with sole fractions, as with fractions, annexed to Integrums, which rule of three is threefold, that is, the common rule, the rule reuerse, and the double rule, the order of all which three kindes, I doe plainely teach by examples, shewing wherein, how & when they are to be vsed. Next to those I set downe the rule of fellowship, a necessarie rule for those that haue to traffique in any trade af Marchandise, giuing diuers examples thereof. Next to that I treate of Arithmeticall and Geometricall Progression, and also of Proportion, and of the three kindes thereof, that is, of Proportion, Arithmetical, Geometricall and Musicall. Then I shew how to finde out the square roote of any number, and also the vse thereof in setting of Battels, and also how to finde out the cubique roote of any number: and last of all I treate of Astronomicall fractions, shewing how to adde, to substract, to multiplie & diuide the same, and also to take the square roote thereof, without the knowledge of which fractions you can neuer calculate any thing truely out of the Astronomical Tables.

Some perhaps do looke here that I should speake somwhat of the rules of Algebra, whereby all subtle and intricate questions of Arithmetike are to bee vnfolded, wherewith I leaue indeede

to

deale, partly, for that I haue not of long time exerciſed my ſelfe therein, and partly becauſe I knowe that one hath begun to write thereof, whoſe Booke being once ended, I doubt not but that hee will ſhortly after print the ſame to the great profit & furtherance of all thoſe that delight in ſuch good exerciſes. But in the meane time I haue thought good to adde (as I haue ſaide before) vnto this Arithmeticke a plaine deſcription, together with the vſe of the Tables of Sines, of lines Tangent and Secant, which Tables will pleaſure many that would gladlie know how, and wherein to vſe them, and ſpecially ſuch ſeamen as haue ſome taſt of Arithmeticke, without the which no good almoſt is to bee done in any ſcience.

This

This Treatise of Arithmeticke containeth 26. Chapters, as followeth.

WHat Arithmeticke is, what Numeration is, and of what partes it consisteth, and what signification euery digit hath according to his place, and how to expresse or tell a great number written in many figures. Chapter. 1.

Of the foure speciall kindes of Arithmeticke, and first of Addition, with examples thereof. Chap. 2.

Of Subtraction, with examples thereof, and how to trie the same. Chap. 3.

Of Multiplication and certaine Tables belonging thereunto, together with the vse thereof, and what is to be obserued therein, with examples and triall thereof. Chap. 4.

Of diuision, and what is to be obserued therein, with examples and triall thereof, and of halfing any number. Chap. 5.

Of the rule of three, called the Golden rule, and what order is to be obserued in working thereby, and of the three kinds thereof. Chap. 6.

Of Fractions what they be, with a demonstration thereof, together with seuen necessary rules belonging to the same, & what euery rule teacheth. Chap. 7.

Of Addition, Subtraction, Multiplication, and Diuision of Fractions. Chap. 8.

Of the common rule of three belonging to Fractions with examples. 9.

Of

Of the rule reuerſe, called in Latine, Regula euerſa, *and the order of working thereby, with examples. Chap. 10.*

Of the double rule called in Latine Regula duplex, *and the order of working thereby, with examples, and in working thereby, how to know when you haue to vſe* Regula euerſa, *or the common rule of three. Chap. 11.*

Of the rule of Fellowſhip, & the order of working therby, with diuers examples thereof. Chap. 12.

Of Progreſsion, what it is, and of the two kindes thereof, that is, Arithmeticall and Geometricall. Chap. 13.

Of addition belonging to progreſsion Arithmeticall, and the order thereof, with examples. Chap. 14.

Of Additiō belonging to progreſsion Geometricall, & the order thereof, with examples. Chap. 15.

Of proportion, what it is, and of the three kinds thereof, that is, Arithmeticall, Geometricall, and Muſicall. Chap. 16.

Of Arithmeticall propertion, what it is, and how it is deuided. Chap. 17.

Of Proportion Geometricall, what it is, and how it is deuided. Chap. 18.

Of the chiefe and ſpeciall kindes of Geometricall Proportion, that is, of equality and inequalitie both greater and leſſer. Chap. 19

Of Proportion of the greater inequalitie, and of the 2. kindes thereof, that is, Simplex, *and* Multiplex, *and of their diuers kinds, with certaine tables belonging thereunto. Chap. 20.*

Of Proportion of the leſſer inequalitie. Chap. 21.

Of Muſicall proportion, what it is, and of the two kindes thereof, that is, Simple, & compound, of which compound there be alſo two kinds, that is proper and vnproper. Chap. 22.

How Proportions are to be ſet downe in writing, & how they are to be added, ſubtracted, multiplyed, and deuided euen like to fractions in all reſpects. Chap. 23.

How

How to finde out the ſquare roote of any number, with examples, Chap. 24.

The vſe of the ſquare roote in ſetting of Battels, which according to the Italian vſe are to be ſet foure manner of wayes, the order whereof is here ſet downe with examples. Chap. 25.

How to finde the Cubique roote of any number, and the order thereof with examples. Chap. 26.

Of Aſtronomicall Fractions, whereto they ſerue, and how to adde, ſubtract, multiplie, and to diuide the ſame. Chap. 27.

How to diuide ſuch Fractions when the diuiſor is greater than the diuidend Chap. 28.

How to take the ſquare roote of Aſtronomicall Fractions. Chap. 29.

And immediately after theſe Chapters doe follow the vſe of the Tables of Sines, lines Tangent, and lines Secant before mentioned, together with the Tables themſelues.

To

Of Arithmetike.

Cap. 1.

WHat is Arithmeticke?

It is the Art of counting or numbring by figures.

What is to number by figures?

It is to expresse the value of any number in his proper Characters & figures, which is called by a Latine name Numeration.

What belongeth to Numeration?

Two things, to know the shapes of the figures, and the signification of their places.

How many figures are there?

These ten, 1.2.3.4.5.6.7.8.9.0. Whereof the tenth made like an o. as you see here, is called a Cypher, which is no number of it selfe, but serueth onely to fill vp a number.

What is number?

Number is a collection or summe of many ones added together.

How is number deuided?

Into three kinds, that is Digit, Article and Compound.

Which be they?

The Digit is any of the first 9. figures before set downe. Article is any number ending in ten, as ten is one Article, twentie is two Articles, thirtie is three Articles, &c. Compound is that which is compounded of Article and Digit, as 13.14.17.24. &c.

Shew what signification euery Digit hath according to his

place, and in what order such place is to be considered in expressing any number?

The order as touching the place, is to begin at the right hand, and so to procede towards the left hand. For any of the 9. Digits whatsoeuer, standing in the first place, which is on the right hand, signifieth the value of himselfe onely, in the second place ten times himselfe, in the third place a Hundreth times himselfe, in the fourth place a Thousand times himselfe, in the fift place ten Thousand times himselfe, in the sixt place a hundreth Thousand times himselfe, in the seuenth place a Myllion, in the eight place ten Myllions, in the ninth place a hundreth Myllions, in the tenth place a thousand Myllions, &c.

Doth the Cypher signifie nothing?

Yes it maketh a place whersoeuer it standeth, so as it be not the outermost on the left hand: for there it hath no place at all, as here you may se in this number, 04500. whereof the first Cypher on the right hand, signifieth the first place, the second Cypher the second place, but the last and outermost Cypher on the left hand, signifieth no place at all, because it hath no Digit, standing before it towards the left hand, and therefore though in this number there be 5. figures, yet it signifieth no more but foure Thousand and fiue Hundreth.

By what meanes may a great number written in many figures, be readily expressed or tolde?

By diuiding the same into diuerse partes with strekes, or prickes made at the end of euery third figure, beginning to tell from the right hand towards the left, as in this number, 4/320/570. In which, beginning with the Cipher on the right hand, I tell one, two, and three, and there make a Streke, and so proceeding forth still towards the left hand, I make a Streeke at the ende of euery third figure, by which Streekes or partitions I make them now seuerall numbers, and euery Streeke must be named by this word Thousand. Notwithstanding, in expressing this number being thus diuided, or any other such like, you must begin at the left hand, and say thus, foure Thousand thousand, three Hundreth twentie Thousand, fiue Hundreth and seuentie: for by reason of this Diuision, the figure 4. standeth here alone, and in the first place, and indeede signifieth 4. Myllions, and by

that

that meanes, you may more fitly expresse the said number in saying thus, foure Myllions, three Hundreth and twentie Thousand, fiue Hundreth and seuentie. And the better to discerne the Myllions from ỹ rest in great numbers, it shal not be amisse to set an M, signifiyng Myllions, right ouer the head of ỹ Streake which is drawne betwixt the firth and seuenth figures, as in this example cõtaining a leauen figures, 34|545ᵐ|678|694. which is to be uttered thus thirtie foure Thousand, fiue Hundreth, fortie fiue Myllions, fire Hundreth seuentie eight Thousand, fire Hundreth ninetie and foure Crownes or Pounds, or whatsoeuer other denomination or name, it shall please you to giue them.

Of the foure speciall kindes or parts of *Arithmetike*.

Cap. 2.

Which are those foure kindes?

These, Addition, Subtraction, Multiplication, and Diuision.

Why is not Numeration also counted as a part?

Because Numeration together with the figures, and places whereof it consisteth, are counted rather as first Elements, and principles of Arithmetike, then as partes or speciall kindes thereof.

Of Addition.

What is Addition?

It is that which teacheth to bring many seuerall summes into one summe.

How is that done?

First by placing euery seuerall number one right vnder another, vnder which you must draw a line, that done, you must adde together the numbers of the first ranke, beginning on the right

hand with the lowest figure of the same rancke, and so going vpward to the highest figure of the same rancke, and so from rancke to rancke, till you come to the last, and if the summe of any rancke doe not excéede the number of any of the foresaid 9. Digits, then set downe that Digit which comprehendeth that number right vnder his proper rancke, beneath the line, but if the summe of that rancke excéedeth the number of any one Digit by reason that it consisteth of Articles and Digits, then set downe the Digit, and kéepe the Article or Articles in your minde, to be added to the first figure of the next rancke of the left hand, but if the summe be an euen Article or Articles: then set downe a Cypher, kéeping the number of Article or Articles in your minde, bée it, one, two, or three, to be added to the next rancke, all which things you shall better vnderstand by this example here following. As for example, I spent in one yeare 125 l. in an other yeare 234. l. and in another yeare 240. l. Now to knowe the totall Summe of all this, I place these seuerall summes one right vnder another, and then I draw a line vnder them as here you see.

	l.
	125.
	234.
	240.
	599.

Then beginning on the right hand with the lowest figure of the first rancke aboue the line, I say that a Cypher and 4. is but 4. Againe 4. and 5. maketh 9. which I set downe vnder the line, then proceéding to the seconde rancke towards the left hand, I say that 4. and 3. maketh 7. and 7. and 2. maketh 9, which also I set downe, then remouing to the third rancke, I say that 2. and 2. maketh 4. and 4. and 1. maketh 5. which I also set downe as you sée in the former example, so as the totall summe vnder the line is 599. l.

Another example hauing Cyphers mixt with Digits.	3047.
	4508.
	3049.
	10604.

Here I say that 9. and 8 maketh 17. and 17. and 7. maketh 24. wherefore I set downe the Digit 4. and kéepe 2 Articles in minde, which being added to the lowest figure of the second rancke, which is 4. maketh 6. then 6. and 4. maketh 10. here I set downe a Cypher, kéeping one Article in mind, which being added to the figure 5. of the third rancke maketh 6. which I also set down, then I say that 3. and 4. maketh 7. and 7. and 3. maketh 10. for ỳ which I set down first a Cypher: and then because there is no more to be added, I set downe on the left hand the one Article which I had in minde, so as the whole

summe

ſumme commeth to 10/604. as in the former example.

How are pounds, ſhillings, pence, halfe pence, & farthings, & all other numbers of diuers Denominations to be added?

You muſt diuide euery ſeuerall name into diuers Collums or Spaces by themſelues, and then beginning with the firſt on the right hand, you muſt adde euery Collum by it ſelfe, bringing farthings to halfe pence, and halfe pence to pence, pence to ſhillings, and ſhillings to pounds, ſetting the ſumme of euery Collum vnder the nether line, as you ſee in this example following.

l.	s.	d.	ob.	q.
345	13	1	0	1
234	11	0	1	1
45	14	9	1	0
320	6	8	1	1
946	5	8	0	1

Heere firſt beginning with the Collum of farthings, I finde there in 3. farthings which is one halfe penie and one farthing. Wherefore I ſet downe the odde farthing as you ſee, and keepe the halfe penie in mind: then adding the halfe pennie in minde to the loweſt halfe pennie of the ſecond Collum, I ſay that 1. in minde and 1. maketh 2. and 2. and 1. maketh 3. then 3. and 1. maketh 4. which 4. halfe pence becauſe they make iuſt two pence, I ſet downe a Cypher keeping the two pence in minde, which two pence being added to 8. maketh 10. then 10. and 9. maketh 19. and 19. and 1. maketh 20. Now becauſe that 20.d. maketh one ſhilling and 8.d. I ſet downe the 8.d. keeping the ſhilling in minde, which one ſhilling being added to the 6. of the next Collum maketh 7. then 7. and 4. maketh 11.s 11. and 1. maketh 12. then 12.s 3. maketh 15. wherefore I ſet downe 5. keeping the Article in minde, which being added to one of the next Collum maketh 2. and 2. and 1. maketh 3. and 3. and one maketh 4. Articles. which 4 Articles maketh 40.s. which is two pound which I keepe in minde, and therefore I adde the 2.l. to the Collum of pounds, ſaying that 2. and 5. maketh 7. and 7. and 4. maketh 11. and 11. and 5. maketh 16. wherefore I ſet downe 6. keeping the one Article in minde, which being added to 2. of the next Collum, maketh 3. then 3. and 4 maketh 7. and 7. and 3. maketh 10. then 10. and 4. maketh 14. wherefore I ſet downe 4. keeping one Article in minde, which being added to 3. of the next Collum maketh 4 then 4. and 2. maketh 6. and 6. and 3. maketh 9. which I alſo ſet downe, ſo as the

totall Summe amounteth to 946.l.5.s.8.d. no halfe penny, one farthing as you see in the former example.

How shall I know whether these severall Summes be truely added or not?

Some doe teach it to be done by culling out all the nines, which way is more tedious then sure: for the surest tryall indeede is to be done by Subtracting the severall Summes out of the totall Summe, of which Subtraction we come now to speake, for all the foure speciall kindes are tryed one by another.

Of Subtraction.

Cap. 3.

WHat doth Subtraction teach?

It teacheth to take a lesser number out of a greater and, to see what remaineth.

What is to be observed in this kind?

First, you must set downe your greater number above, and then the lesser number right under the same. As for example, I have lent to one 564. l. and he hath paid me thereof 57. l. Here to know what remaineth, I first set downe the number lent, and under that the number paid, and then drawe a line as you see in this manner.

Lent.	564 l.
Paide.	57 l.

Here beginning on the right hand, I first say, take 7. out of 4. that cannot be, wherefore I take one Article of the next figure or place of the lent number, which Article being added to 4. maketh 14. then I say take 7. out of 14. and there remaineth 7. which I set downe under the 4. then I adde that one Article which I borrowed, to the second figure of the paide number which is 5. saying that 5. and 1. in minde maketh 6. then take 6. out of 6. and there remaineth nothing, wherefore I set downe a Cypher, under the 5. of the paid number, then I proceede to the third figure of the lent number, which

which is 5. and because I finde nothing written vnder it, nor haue nothing in minde to take out of it, I say, take nothing out of 5. & there remaineth still 5. so as the remainder is 507.l. as you see in this example following.

Lent	564.l.
Paide	57.
Remaine	507.

How shall I knowe whether this bee right or not?

By adding the remainder and the number paide together, the Summe whereof (if you haue done well) will be all one with the number lent, as in the former example, I first adde 7. and 7. to gether and that maketh 14. wherefore according to the precepts of Addition before taught, I set downe 4. keeping the Article in minde, then I say, one in minde and 5. maketh 6. which I also set downe, then I say nothing and 5. is 5. which I set downe in the third place, which in all maketh 564. a number equall to the number lent, as you see here following.

Lent	564.l.
Paide	57.
Remaine	507.
Proofe	564.

You may perceiue by this, that if any figure of the paid number be greater then the figure ouer him, out of the which it is to bee Subtracted, you must alwaies borrow one Article of his next fellow, to be added againe to him in his proper place. But you haue to note, that hauing to deale with numbers of diuers denominations, then in borrowing any number, you must alwaies haue respect to the Denomination or name of the thing, from whence you borrow, as in borrowing from shillings you borrow 12. and not 10. from pounds you borrow not one Article but 2. Articles wh ich doe make 20. s. but when the whole number is altogether of one selfe Denomination, then you must alwaies borrow one Article which is 10. to make vp your number that wanteth. As you shall more plainely perceiue by this example containing numbers of diuers Denominations, as of pounds, shillings and pence, halfe pence, and farthings. Suppose therefore that you haue lent to one 467.l. 13. s. 4. d. ob. q. and hee hath paide you againe thereof, 89.l. 16. s. 9. d. ob q. Here hauing set downe the summe lent in seuerall collums, according to their diuers names, and then the summe paide, right vnder the same, draw a line as you see in this example following.

	l.	s.	d.	ob.	qr.
Lent.	467	13	4	1	1
Paide.	89	16	9	1	0
Remaine.	377	16	7	0	1

Here beginning with the first Collum on the right hand, I say take nothing out of one, and one still remaineth, which I set down, then proceeding to the next, I say take one out of one and nothing remaine, wherefore I set downe a Cypher, then proceeding to the nert Collum, I say take 9. out of 4. that cannot be, wherefore I borrow a shilling of the nert Collum that is 12.d. which being added to 4. maketh 16. pence, then I say take 9. out of 16. and there remaineth 7. which I set downe, then proceeding to the nert I adde the one shilling which I borrowed, to the 16. which maketh 17. then I say take 17.s. out of 13.s. that cannot be, wherefore I borrow one pound which is £. Articles of the nert rancke, that is 20.s. which being added to the 13.s. maketh 33.s. then I say take 17. out of 33.s. and there remaineth 16.s. which I set downe, then I adde the one pound which I borrowed, to 9.£ that maketh 10. then I say take 10. out of 7. that cannot be, wherefore I borrow one Article out of the nert 6. which being added to the 7. maketh 17. then I say take 10. out of 17. and there remaineth 7. which I set downe, then the one, which I borrowed, I adde to the 8. of the nert rancke, and that maketh 9. Againe I say take 9. out of 6. that cannot be: wherfore borrowe one Article of the nert 4. which being added to 6. maketh 16. then I say take 9. out of 16. and there remaineth 7. which I set downe, then I take the one which I borrowed out of the 4. and there remaineth 3. so as the remainder is as you see in the former example. 377. l. 16.s. 7.d. no ob. 1.qr.

How shall I trie whether this be true or not?

By adding the remainder and the Summe paide together: as in the former example, and of that addition, will rise if you haue done truely a Summe like in euery condition to the Summe lent: In making which proofe or triall you cannot lightly erre, if you remember to reduce pence to shillings, and shillings to pounds, and therefore in the Collum of pence, no particular Summe can be aboue 11.d. nor in the Collum of shillings no particular Summe can be aboue 19.s. for if it be 20.s. then it is a pound and must be brought to the Collum of pounds.

Of

Of Multiplication.

Cap. 4.



What is Multiplication?

It is the producing or bringing foorth of a third number, by Multiplying two other numbers the one into the other: And it consisteth of three numbers, that is the multiplycand, the multiplyer, and the product.

What signifieth those names?

The Multiplicand is that number which is to be multiplyed, and the multiplyer is that whereby the same is multiplyed, & the product is the summe of such Multiplycation: As for example, if I would multiply 4. by 3. as in saying 3. times 4. maketh 12. here the number of 4. is the Multiplycand, and the number 3. is the multiplyer, and the number 12. is the product of that Multiplycation.

What order is to be observed in multiplying, & how are those numbers to be set?

Before I teach you the true order of multiplying, I thinke it good to set you downe a table of Multiplycation, which unlesse you learne perfectly by heart, you shall never multiplie readily nor quickly.

The first Table of Multiplycation.

2	2	4	3	5	15	4	9	36	5	8	48		9	9	81
2	3	6	3	6	18	4	10	40	6	9	54		9	10	90
2	4	8	3	7	21	5	5	25	6	10	60		10	10	100
2	5	10	3	8	24	5	6	30	7	7	49				
2	6	12	3	9	27	5	7	35	7	8	56				
2	7	14	3	10	30	5	8	40	7	9	63				
2	8	16	4	4	16	5	9	45	7	10	70				
2	9	18	4	5	20	5	10	50	8	8	64				
2	10	20	4	6	24	6	6	36	8	9	72				
3	3	9	4	7	28	6	7	42	8	10	80				
3	4	12	4	8	32										

How

How is this Table to be read?

In this manner 2. times 2. maketh 4. and 2. times 3. maketh 6. and 2. times 4. maketh 8. and so foorth: multiplying still one Digit by another, vntill you come to 100. for this Table serueth onely for Digits, which may bee made to extend so farre as you will, and vntill you haue learned the foresaid Table without booke, you may helpe your selfe with this other Table of Digits made squire wise as you see here:

	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	1
2	4	6	8	10	12	14	16	18	2	
3	9	12	15	18	21	24	27	3		
4	16	20	24	28	32	36	4			
5	25	30	35	40	45	5				
6	36	42	48	54	6					
7	49	56	63	7						
8	64	72	8							
9	81	9								

In the front of which Table are set down the 9. Digits beginning on the left hande, and so proceeding to the right hand, from 1. to 9. Againe on the right side of the said Table are set downe the foresaide 9. Digits beginning a boue and so proceeding right downe from 1. to 9. the vse whereof is thus, first seeke the Digit to be Multiplied in the front, and seeke the other wherby you haue to multiply the same on the right hand, and the square Angle answering to these 2. Digits will shew the product of such Multiplication. As for example, hauing to multiply, 7. by 6. I first seeke the greater Digit which is 7. in the front, and the lesser which is 6. on the right hand, the product whereof I find in the square Angle answering both to 7. and to 6. to be 42. and the like is to be obserued in any 2. Digits that are of like value, as 7. times 7. the product whereof is 49. But the first Table being perfectly learned without booke, whensoeuer you haue to multiply one number by another, you must obserue these rules here following.

First that you set downe the first figure of your multiplyer right vnder the first figure of the number that is to be multiplyed, on the right hand, and then orderly to place the rest of the figures of your multiplier, be the few or many, towards your left hand, directly vnder the rest of the figures of the number that is tobee multiplyed, for if the figures stand not in order one right ouer another

other, it will breede a confusion in your working. Secondly you must not forget to multiply all the figures of the number that is to be multiplyed by the first figure of your multiplyer before you deale with the next multiplyer, beginning alwaies on your right hand, and so to proceed from one to another, wherby you shal make as many severall products as there be figures in your multiplyer. Thirdly you must remember to set downe the first figure of every severall product, right under the figure of that multiplier, whereby you doe multiply, and having ended your Multiplication, draw a line under the severall products: ỳ done, adde ỳ severall products together according to the rules of Addition, & the summe thereof shalbe the total or general product of that Multiplycatiõ: all which rules you shall the better understand by working this example following. Suppose thẽ that you would know how many houres there are in a peare, knowing first ỳ a peare consisteth of 365. daies, here because that every naturall day containeth 24 houres comprehending both day & night, you haue to multiply 365. by 24. and therefore you must first set down 365. because it is the greater number, and is the multiplicand, which must alwaies stand aboue, & right under ỳ, your multiplyer which is 24. is to be set downe in his due place, according to the Rules before taught thus as you see here.

Then say thus 4. times 5. maketh 20. & having set down a Cypher right under the 4. keep the 2. Articles in mind, thẽ say 4. times 6. is 24. & 2. in mind is 26. here set downe 6.

365. the multiplicãd
24. the multiplier.

and keepe 2. in mind, then say 4. times 3. is 12. which with the 2. in minde maketh 14. here first set downe the 4. under the 3. and because you can proceede no further, you must therefore set downe hard by the 4. on the left hand the one Article which you had in minde, then having cancelled the first figure of the multiplyer, by making a dash through it with your penne, as you see in the example following: Proceede with the other figure of the multiplyer, saying that 2. times 5. maketh 10. wherefore set downe a Cypher right under the said 2. keeping the one Article in minde, then say, 2. times 6. is 12. and one in mind maketh 13. wherefore set downe 3. and keepe one in minde, then say 2. times 3. is 6. which with one in minde maketh 7. the which you must set downe. and because you haue made an end of your multiplication, cancell

the

the 2. and draw another line vnder the 2. seuerall products, that done, adde together whatsoeuer is contained betwixt the two lines, and you shall finde the generall product to be 8760. houres.

The multiplycand.	365
The multiplyer.	24
The seuerall products.	1460
	730
The generall product or totall sum.	8760

How shall I know whether the last Multiplycation be right or no?

By diuiding the generall product by the Multiplyer, for in so doing your quotient will be like vnto the first Summe that was Multiplyed, which you cannot doe, vntill such time as you haue learned to diuide, and therefore hauing first shewed certaine compendious waies of Multiplication, I will then proceede to Diuision.

Certaine compendious waies of Multiplication.

WHen is any such way to be vsed?

When the Multiplyer beginning on the right hand with one Cypher or with many, endeth on the left hand with the Digit 1. as these numbers following. 10/100/1000/&c.

Why, what is then to be done?

If you haue to Multiply by 10. then you haue no more to doe, but to set downe on the right hand of the number that is to be Multiplyed, one Cypher, if by a 100. then 2. Cyphers, if by a 1000. then 3. Cyphers, as for example: if you would Multiply 365. by 10. then by setting downe on the right hand one Cypher as hath beene said, the product will be 3650. if you set downe 2. Cyphers the product will be 36500. if you set down 3 Cyphers, then the product will be 365000.

What if the number do end on the left hand with any other Digit, as 2. 3. or more, as 200 300. 400?

Then you must Multiply the number of the Multiplycand first by that Digit, and then adde to the end of the product on the right hand all the Cyphers annexed to the said Digit, as if you would Multiply 365. by 200. First say 2. times 5. maketh 10. and 2. 6. and 1. in mind is 13. and so to proceede in Multiplying euery figure of the Multiplycand by 2. and you shall finde the product

duct to be 730. whereunto if you adde on the right hand 2. Cyphers, the whole product will be 73000.

Of Diuiſion.

Cap. 5.

WHat is Diuiſion?

Diuiſion is that whereby any number is diuided into as many parts as you will.

How many numbers are incident to Diuiſion, and how are they called?

Theſe foure, that is to ſay, the number which is to bee diuided, which is called the diuidend, the ſecond number whereby you do diuide, which is called the Diuiſor, the third number is called the quotient, which ſheweth how many times the Diuiſor is comprehended in the diuidend, and the fourth number is called the remainder, if any be.

What order is to be obſerued in Diuiſion?

This here following, firſt ſet downe your diuidend and directly vnder that, beginning on the left hand, ſet downe your Diuiſor, that is to ſay, the firſt figure of your Diuiſor right vnder the firſt figure of your diuidend on the left hand, and ſo conſequently one after another proceeding towards the right hand, which is alwaies to be done, ſo often as your Diuiſor doth not exceed in quantitie, the figure ſtanding right ouer his head, for if it doe, then you muſt remoue your Diuiſor one figure further towardes the right hand. As for example, if you would diuide 487. by 53. you muſt not ſet the firſt figure of your Diuiſor which is 5. vnder the firſt figure of your diuidend, which is but 4. but vnder the ſecond figure of your diuidend, which is 8. for you cannot take 53. out of 48. and therefore you muſt ſet the firſt figure of your Diuiſor, vnder the ſecond figure of the diuidend, and ſo follow on with the reſt, and then draw a line, as you ſee here in this example following.

What is the to be done? The diuidend. 487. (9. the quotient.
The diuiſor. 53.

Then you muſt aſke how many times 5. is comprehended in 48. and you ſhall finde that 5. is comprehended in 48. 9. times.

which

which 9. being the quotient, must be placed on your right hande, behinde a crooked line made like a halfe Mone as you see in the example aboue, then Multiply the first figure of the Diuisor by the quotient 9. and the product thereof shall be 45. which being taken out of 48. there will remaine 3. which you must set downe ouer the head of 8. and strike out the 48. and also the first figure of your Diuisor which is 5. that done Multiply the second figure of your diuisor which is 3. by the foresaid quotient which is 9. and the product thereof wil be 27. which being take out of 37. there remaineth 10. which you must set ouer the head of 37. and cancell the 37. and also the 3. beneath, as you see in this example following.

Wherein you see that the diuidend is 4787. the diuisor 53. The diuidend. 4787 (9. the quotient
the quotient 9. and The diuisor. 53
the remainder 10. which if you will apply to any vse, you may imagine that there is 487. l. to be diuided amongst 53. soldiours, and by working as before, you shal find that euery Souldiour must haue 9. l. and there shall be remaining 10 l. to be diuided amongst the foresaide 53. Souldiours, which 10. l. being reduced to shillings, may be diuided amongst the Souldiers as well as the pounds: As for example if you Multiply 10 l. by 20. s. it will make 200. s. which being diuided by 53. the first diuisor, the quotient will be 3. s. and the remainder 41. s. and that being reduced into pence, which is done by Multiplying 41. by 12. the quotient will be 9. d and the remainder 15. d. which if you Multiply by 4 you shall reduce them to farthings, the product whereof will be 60. which product being diuided by 53. the first Diuisor you shall finde in the quotient 1. farthing, and the remainder to be $\frac{7}{53}$ of a farthing, the value of which Fraction how to find out is taught hereafter when wee come to speake of Fractions. So as you see by this meanes that euery Souldiour shall haue for his share 9. l. 3. s. 9. d. q. and some what more, a thing of no moment.

How many things are to be remembred in Diuision.

These fiue Rules here following. First that you put no number at one time in the quotient aboue 9. Secondly to moderate your quotient in such sorte, as hauing Multiplyed the first figure of the Diuisor by the quotient, there may remaine sufficient for the

the next figure of the Diuiſor being Multiplyed by the quotient to be deducted out of that number, which ſtandeth right ouer his head. Thirdly that you Multiply euery figure contained in the Diuiſor by the quotient. Fourthly, that if at any time in working it happeneth ſo as your Diuiſor is not comprehended in the number ouer his head, then to put a Cypher in the quotient, and to remoue your Diuiſor one figure further towardes the right hand, and that done to worke as before. Fiftly to ſee that the laſt remainder, if there be any left, doe not exceede in quantitie the Diuiſor, all which things you ſhall better vnderſtand by this one example following: Suppoſe then that you haue to diuide 81 9096. by 92. here hauing ſet downe your Diuidend and Diuiſor in ſuch order as is before taught, and as you ſee here in this example.

First aſke how
many times 9. is in 8
81. and you ſhal find 93
the quotient to be 8. The dinidend. 81 9096 (8 the quotiet
which being multi- The diuiſor. 92
plyed into 9. maketh
72, which if you take out of 81. there ſhall remaine 9. which muſt be ſet downe ouer the head of the figure 1. and cancell the ſaid 81. together with the firſt figure of the Diuiſor, which is 9. then ſay 2. times 8. is 16. which being Subtracted out of 99. there remaineth 83. which you muſt ſet ouer the head of the 99. and cancell the 99. that is aboue, and alſo the 2. beneath, as you ſee in the former example. That done remoue your Diuiſor towardes the right hand, that is to ſay, by ſetting the laſt figure of your Diuiſor which is 2. vnder the next Cypher on the right hand, and place the firſt figure of your Diuiſor which is 9. next to that towardes the left hand: then aſke how many times 9. is comprehended in 83. and you ſhall find 9. times, which 9. muſt be ſet downe in the quotient next to the 8. then ſay 9. times 9. is 81. which being taken out of 83. there remaineth 2. then hauing ſet downe the 2. ouer the head of 3. cancell the 83 aboue & alſo the 9. beneath, then Multiply the laſt figure of the Diuiſor which is 2. by the 9. which is in the quotient, and the product thereof is 18. which being taken out of 20. there remaineth 2. which 2. muſt be ſet downe ouer the Cypher, and the Cypher cancelled, and alſo the 2. beneath, as

you

you se in this example following.

That done remoone your Diuisor one figure further towards the right hand by setting the 2, vnder the 9. which is the last figure saue one of the diuidend, and place the first figure of your Diuisor which is 9. next to that on the left hand, then aske how many times 9. is contained in 2. and you shall finde none, wherefore you must set downe a Cypher in the quotient, and cancell the Diuisor, as you se in this example.

	2	
The diuidend,	8 x 9 0 96	(890.
The diuisor,	9 2	

That done remoone your Diuisor againe by setting the 2. vnder the last figure of the diuidend, and place the 9. next to that on the left hand, then aske how many times 9. is contained in 29. and you shall finde 3. times, which 3. you must set downe in the quotient as you se in the example following, then Multiply the first figure of your Diuisor which is 9. by 3. and the product thereof will be 27. which being taken out of 29. there will remaine 2. which 2. you must set ouer the head of 9. and cancell the 9. aboue, together with the 9. beneath, then Multiply the 3. which is in the quotient by the last figure of your Diuisor which is 2. and the product thereof will be 6. which being taken out of 29. there remaineth 20. wherefore you must set downe a Cypher ouer the 6. which is the last figure of the diuidend, and cancell the said 6. aboue, and also the 2. beneath, and then you haue done rightly, and in such order as all the former examples, and this also next following doe plainely shew.

		the remainder.
	2 20	20.
The diuidend,	8 x 9 0 9 6	(8903 92.
The diuisor,	9 2	the quotient.

For heere you se that the diuidend is 819096, the Diuisor 92. The diuisor, the Quotient 8903. and the remainder 20, which remainder must be set on the right hand of the quotient ouer the Diuisor, hauing a line drawne betwixt them as you se in the last example.

How

How ſhall I know whether I haue diuided truely or not?

By Multiplying the quotient by your Diuiſor, & by adding to the product thereof the remainder, for ſo ſhall you haue a number like to the firſt dividend if you haue wrought well, if not, then your ſumme will be either more or leſſe then the dividend.

Certaine compendious waies of Diuiſion.

IS there no ſhorter way of Diuiſion?

No, vnleſſe the Diuiſor hath one Cypher or more on the right hand, for then you may vſe a briefer way by cutting off the laſt figure, or figures of the dividend: As for example, if you had to diuide 3708. by 10. here cut off the laſt figure 8. with a dath of your penne in this wiſe 370/8. and the quotient will be 370. and the remainder ſhal be 8. Againe if you had to diuide the foreſaid number by 100. then cut off the 2. laſt figures of the dividend, that is the 8. and the Cypher ſtanding next it, & then the quotient will be but 37. and the remainder 8. as before, but if you haue to diuide any number by 1000. then you muſt cut off 3. figures of the dividend, and ſo forth, remembring alwaies for euery Cypher in the Diuiſor, to cut off one figure or Cypher of the dividend.

Of halfing any number.

HOw is that done?

By dividing the number by 2. As for example, if you would know the halfe of 3708. diuide the ſame by 2. and you ſhall find the quotient to be 1854. which is the iuſt one half of the dividend.

Of the Rule of three, otherwiſe called *the golden Rule, whereof there be* three kinds, that is, the common Rule, the rule Reuerſe, and the Double rule.

Cap. 6.

WHerfore is it called the Rule of three?

Becauſe that by 3. knowne numbers, it teacheth you to finde out a fourth number vnknowne.

How are ſuch 3. numbers to be placed?

The firſt is to be placed on the left hand, the third on the right hand, and the ſecond in the middeſt betwixt both.

How ſhall I know in what place each one is to be ſet?

By marking to what number the queſtion is annexed, for that muſt alwaies be the third number, and hauing the third number, you ſhall quickly haue the firſt, becauſe the firſt and third muſt alwaies be of one ſelfe Denomination or name, betwixt which two, the ſecond number is to be placed: As for example, let this be the queſtion. If I pay 35.ſ. for 13. yards of Linnen Cloth, how much ſhall I pay for 3. yards, here becauſe the queſtion is annexed to the number 3. yards, that muſt be the third number, and is to be placed on the right hand, then becauſe that the number 13. yards is of the ſelfe ſame Denomination, that muſt be the firſt number, and is to be placed on the left hand, and the number 35.ſ. (which is the price) is to be placed in the middeſt betwixt the other two, as you ſée here following.

Now muſt you make your queſtion in this manner, if 13. yards did coſt me 35.ſ. what ſhall 3. yards coſt me, and ſo the firſt and laſt ſhall be of one denomination or name, that is to ſay, yards.

yardes.	ſ.	yardes.
13.	35.	3.

What order is to be obſerued in working by this rule?

You muſt Multiply the third and ſecond numbers the one into the other, and diuide the product thereof by the firſt, and the quotient will ſhew you what the fourth number ſhould be, which fourth number is alwaies of like Denomination to the ſecond or middle number, as in the former example, firſt multiply 35. by 3. and the product will be 105. which if you diuide by 13. the quotient will be 8.ſ. and one third of a ſhilling which is 4.d. and that is the price of 3. yards which is the number that you ſéeke to know. And this is the common kind of working by the Rule of thrée, whereof it is called the common Rule of thrée.

What if there be diuers Denominations either of Coyne as of pounds, ſhillings, and pence, or parts of yards, as quarters, halfe quarters, and ſuch like?

Then you muſt reduce them all to the ſmalleſt Denomination which belongeth to Fractions, whereof we come now to treate.

Of Fractions.

Cap. 7.

WHat are Fractions?

They are broken partes of ſome whole thing called in Latine Integrum.

What is Integrum?

Any thing that is whole, and not broken, or divided into partes: As one whole yard, a pound, a ſhilling.

Of how many numbers doth a Fraction conſiſt?

Of two, that is the Numerator, and the denominator, whereof the Numerator is alwaies ſet aboue, and the denominator beneath, having a little line drawne betwixt them thus ½ which ſignifieth one ſecond or one halfe, againe 2 thirds and three fourths are written thus, ⅔ ¾ whereof the firſt ſignifieth two thirds, and the other three fourths and ſuch like.

What is ment by theſe two words Numerator, and Denominator, and whereto ſerue they?

The denominator is as much to ſay as the maner of the parts, which ſheweth into how many parts the integrum is to be diuided, and the Numerator is as much to ſay as the numberer, and ſheweth how many of thoſe parts are to be taken: As for example ⅞ of a ſhilling, here the nethermoſt called the denominator, ſheweth that the ſhilling is to be diuided into three parts, as into three groates, and the vpper number called the Numerator, ſheweth that you muſt take 2. out of thoſe 3. parts, ſo as ⅞ of a ſhilling is as much to ſay as 2. groats or 8. d. Againe Fractions may be diuided into two kinds, that is, into ſimple Fractions, and into Fractions of Fractions.

Define thoſe two kinds.

Simple Fractions are ſuch as I ſpake of before, which are the firſt & immediate parts of any integrum that is diuided into parts,

but if thoſe Fractions be diuided into moꝛe Fractions, then are they called Fractions of Fractions, as when I ſay thꝛee fourthes of two thirds, of ſix ſeuenthes and ſuch like.

How are ſuch Fractions to be ſet downe in writing?

In manner of ſimple Fractions thus $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{6}{7}$.

Make ſome demonſtration of this example that I may the better vnderſtand it.

Imagine that there is a whole peece of Gold of vii. s. as our Angell in times paſt hath been, which vii s. be the vii. parts of that peece of Gold, foꝛ tryall whereof lay downe beſoꝛe you vii. twelue pennie peeces of Siluer, oꝛ in ſteede therof vii. counters, to ſignifie thoſe vii. partes, of which vii. parts you muſt firſt take away vi. reiecting oꝛ laying aſide the od ſeuenth part, then diuide thoſe 6. parts into 3. parts, and euery ſuch part wil be iuſt 2 s. of which 3. parts you muſt take away 2. parts, that is 4. s. reiecting the other third part, which remaineth, that done, diuide thoſe 2. parts which you haue taken away into 4. parts. which is 4. s. & take 3. of them reiecting the fourth part, ſo ſhall you find that $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{6}{7}$ of the foꝛeſaid peece of Gold is iuſt 3. s. and there remaineth ſtill of the parts reiected 4 s. which being added to 3. s. that was taken away, do make vp againe the whole Integrum of 7. s. Notwithſtanding Fractions of Fractions doe ſeldome chaunce in the Diuiſion of any number, but if they do, you muſt reduce them into ſimple Fractions, beſoꝛe you can deale with them any manner of way, and becauſe there are diuers rules belonging to Fractions, without the knowledge whereof you can neither adde, noꝛ ſubtract them, noꝛ yet ioyne them with any Integrum, I will briefly ſet downe here ſeuen neceſſarie rules foꝛ the ſame.

Seuen neceſſary Rules belonging to Fractions.

WHat doth the firſt Rule teach?

To bring Fractions of Fractiõs into ſimple Fractiõs.

How is that done?

Thus, Multiply the firſt Numeratoꝛ into the ſecond, and if there be any moꝛe Fractions, then Multiply alſo the ſaid pꝛoduct of the firſt two Numeratoꝛs into the third Numeratoꝛ, and that

ſhall

shall be the Numerator of the simple Fraction, then Multiply the denominators in like manner, and the Summe thereof shall be the denominator of the simple Fraction, as in the former example ½ of ⅓ of ⅚ here I Multiplie the first 2. Numerators together, in saying 2. times 3. maketh 6. now because I haue a third Numerator I multiply the product of the first 2. Numerators, which is 6. into the third Numerator which is also 6. saying, 6. times 6. maketh 36. and that shall bee the Numerator of the simple Fraction, which I set downe. Then by Multiplying the 3. denominators in like maner, I finde the denominator of the simple Fraction to be 84. the which I set downe vnder the 36. and draw a line betwixt them so as now I finde that ½ of ⅓ of ⅚ do make 36/84 which indeed is no more but ⅜ as you shall learne hereafter by the sixt rule.

VVhat doth the second rule teach?

To bring Fractions being more in value then Integrums into Integrums.

VVhen are Fractions said to be more then Integrums?

When the Numerator is a greater number then the denominator, for if they be both of like value as 14/14 and such like, then such Fraction is an euen Integrum.

How shal I know how many Integrums such Fractiõs as be more then Integrums doe containe?

By diuiding the Numerator by the denominator, and if any thing remaine, write that aboue the denominator, as in this example 806/7 here if you diuide 806. by 7. which is the denominator, you shall finde the quotient to containe 115. Integrums, and the remainder to be 1. which is ⅐.

VVhat doth the third rule teach?

To bring Integrums into parts by Multiplying the number of the Integrums by the denominator of those partes, as if you would bring 64. pardes into quarters, Multiply 64. by 4. & there will arise thereof 256. quarters.

What doth the fourth rule teach?

It teacheth to bring Integrums hauing Fractions annexed to them, into one Fraction.

How is that done?

Multiply the number of the Integrums by the denominator of the Fraction annexed, & then adde to the product the Numerator

of the ſaid Fraction, and that ſumme ſhall be the Numerator, vnder which write the denominator aforeſaid, and ſo you ſhall finde that 23. Integrums hauing $\frac{2}{3}$ annexed thereunto ſhall make $\frac{71}{3}$.

What doth the fifth rule teach?

It teacheth to expreſſe a Fraction written with many figures, in ſo fewe as may be.

How ſhall I doe that?

Thus, finde out ſome number that may firſt diuide the Numerator, and then the denominator ſeuerally by themſelues, without leauing in either of them any remainder, and the quotient of the firſt Diuiſion will ſhew the Numerator, and the quotient of the ſecond Diuiſion will ſhew the denominator, but if you cannot readily finde out a number that will diuide them both without leauing ſome remainder, then leaue not to Subtract the leſſer number out of the greater, vntill you finde two like numbers, by one of the which two like numbers diuide the Numerator, and alſo the denominator ſeuerally as before, and the quotient will ſhew that which you ſeeke, but if ſuch two like nnmbers cannot be found, then you may aſſure your ſelfe that the Fraction cannot be written in fewer figures then they already be.

Giue examples of theſe two waies.

For example of the firſt way, ſuppoſe that you would expreſſe $\frac{9}{12}$ in leſſer numbers, here ſeeke out ſome number that may diuide euenly both the Numerator, and alſo the denominator, without eauing in either of them any remainder, which by deuiding each of them by the number of 3. you may doe: For by aſking how many times 3. is contained in 9. the quotient will be 3. and in aſking how many times 3. is contained in 12. the quotient ſhall be 4. ſo ſhall you finde $\frac{9}{12}$ to be no more then $\frac{3}{4}$. Now for example of the ſecond way, let $\frac{27}{81}$ be the Fraction which you would ſet down in fewer figures, here becauſe you cannot readily finde out a number that will euenly diuide both the Numerator & the denominator, Subtract the leſſer out of the greater, that is to ſay 27. out of 81. and there will ſtill remaine 54. from which Subtract 27. and there will remaine 27. which 2. numbers becauſe they are both like, diuide the Numerator and denominator of the foreſaide Fraction, each of them by one of theſe numbers, that is to ſay, by 27. and the quotient of the firſt Diuiſion will ſhew you the numerator which

is

is 1: and the quotient of the second Diuision will shew you the denominator which is 3. so as you shall find $\frac{1}{3}$ to be as much in value as $\frac{37}{111}$ and note that when there be Cyphers both in the Numerator and in the denominator standing in such sort as they may be euenly cut off, the remainder will shew the fewest figures, wherein the Fraction may be written as $\frac{100}{100}$ here by cutting off the two Cyphers as well beneath as aboue the line, with a dash of your penne in this manner $\frac{1}{1}/\frac{00}{00}$ the remainder shall be $\frac{1}{1}$ which is as much in value as $\frac{100}{100}$. And Fractions may be set downe in Minimis, that is to say, in the least numbers more readily by Diuision, then by Subtraction in this maner: first diuide the greater number by the lesser, and if there be no remainer left: then by that remainer diuide the last Diuisor that went next before, continuing still so to doe, vntill you find such a number as will euenly diuide the last Diuisor, without leauing any remainer, for that number will diuide both the Numerator and also the Denominator of the giuen Fraction, without leauing any remainer. As for example, suppose the giuen Fraction, to be $\frac{36}{15}$ which you would set downe in Minimis or smallest numbers: here hauing diuided 36. by 15. you find the remainer to be 6. by which 6. you haue to diuide againe the last Diuisor which is 15. and you shall finde the remainer to be 3. which doth euenly diuide 6. without leauing any remainer at all. Wherefore you may boldly say that 3. is the common Diuisor, as wel to the Numerator as to the Denominator of the giuen Fraction, for if you diuide 36. by 3. you shall finde in the quotient 12. which shall be the Numerator of the new found Fraction, & by diuiding the Denominator of the giuen Fraction, which is 15. by 3. you shall haue in the quotient 5. and that shall be the Denominator of the new found Fraction, so shall the new found Fraction be $\frac{12}{5}$ which is in value as much as the giuen Fraction $\frac{36}{15}$. And you haue to note that such numbers as may be euenly diuided by another number without leauing any remainer, are called compounds. But such as cannot be diuided but that there will remaine some od Unite, those are called Primes. You haue also to vnderstand that if the giuen Fraction be such as the greater number thereof, may at the first be euenly diuided by the lesser number, without leauing any remainer, then the quotient of that first Diuision shall be the common Diuisor. As for example let $\frac{37}{111}$ be the

giuen Fraction, as it was in the first example that was to be wrought by Subtraction here by diuiding the greater number by the lesser, you shall finde no remainer, but onely 3. in the quotient which is the common Diuisor, for if you diuide the Numerator of the giuen Fraction 27. by 3. the Numerator of the new found Fraction will be 9. and hauing diuided the Denominator of the giuen Fraction which is 81. by 3. the Denominator of the new found Fraction will be 27. which is no more in value but $\frac{1}{3}$ for if you diuide 9. by 3. the quotient will be 3. and if you diuide 27. by 3. the quotient will be 9. againe by diuiding 9. by 3. the quotient will be 3. then aske how many times 3. is contained in 3. and there will be but 1. and by asking how many times 3. is contained in 9. you shall find 3. so as the new Fraction shall be $\frac{1}{3}$ and thus you see that $\frac{9}{27}$ or $\frac{3}{9}$ is either of them but $\frac{1}{3}$ and that the number 3. which was the first quotient, is the common Diuisor as well to the Numerator as to the Denominator of the first giuen Fraction. And loke as compound Fractions may be set downe in Minimis by Diuision, so may compound proportions be set downe in Minimis by like manner of Diuision, as shall be declared hereafter when we come to speake of proportions.

What doth the sixt rule teach?

It teacheth to find out the value of the Fraction of any integrum.

How is that done?

Thus, Multiply the Numerator by the knowne partes of the Integrum, and diuide the product thereof by the denominator, so shall you haue the value of the Fraction: As for example, if you would know the value of $\frac{3}{4}$ of an Angell, consider first what parts an Angell hath, and you shall find the parts thereof to be 10. s. or 30. groats, here if you multiply 3. by 10. s. it will make 30. s. which being diuided by 4. you shall find in the quotient 7. s. and the remainder to be $\frac{3}{4}$ or one half of a shilling, which is 6. d. Againe if you multiply 3. by 30. groates it will make 90. groats, which being diuided by 4. you shall finde in the quotient 22. groats, and the remainder to be $\frac{3}{4}$ or one halfe of a groat which is 2. pence, making in all 7. s. 6. d. like vnto the first Summe, so as you see that $\frac{3}{4}$ of an Angell is 7. s. 6. d. and thus you may deale with the Fractions of any other Integrum that hath knowne parts.

What doth the seuenth rule teach?

It

It teacheth to bring Fractions of diuers denominations to one selfe denomination, without the which neither Addition, nor Subtraction of Fractions can be made: As for example if you would adde $\frac{2}{3}$ and $\frac{4}{5}$ together, you must first bring them to one selfe denomination thus, Multiply the denominators the one into the other, and the product thereof shall be a common denominator to both the Fractions, wherefore say 3. times 5. do make 15. which must be set downe in 2. seuerall places by themselues thus 15. and 15. then multiply the Numerator of the first Fraction into the denominator of the second, as 2. into 5. maketh 10. which set downe ouer the first cõmon denominator thus $\frac{10}{15}$ then multiply the Numerator of the second Fraction into the denominator of the first Fraction, as 4. into 3. which maketh 12. and that must be likewise set downe ouer the second common denominator thus $\frac{12}{15}$ so shall you find that $\frac{2}{3}$ and $\frac{4}{5}$ are all one in value with $\frac{10}{15}$ and $\frac{12}{15}$.

Additions of Fractions.

Cap. 8.

HOw are Fractiõs to be added together? Fractions being first brought to one denomination are easily added, for then you haue no more to doe but to adde the Numerators together, and to write the common denominator vnder the Summe of such Addition, as in the former example, $\frac{10}{15}$ being added to $\frac{12}{15}$ maketh $\frac{22}{15}$ but if the denominators be not like, then you must make them like by the seuenth rule before taught.

What if there be three Fractions of diuers denominations to be added together as $\frac{2}{3}\frac{3}{4}\frac{4}{7}$.

Then hauing reduced the 2. first to one selfe denomination, adde the 2. Numerators together and write vnder the Summe thereof the common denominator, that done, deale with that Fraction last found, and with the third as you did before with the 2. Fractions that had diuers denominations, and so you shall find that $\frac{2}{3}$ and $\frac{3}{4}$ being

being first brought to one denomination, and then added together doe make $\frac{17}{15}$ whereto if you will adde $\frac{4}{5}$ then you must bring them againe to one selfe denomination, and so you shall finde that $\frac{17}{15}$ and $\frac{4}{5}$ doe make $\frac{81}{60}$ and $\frac{48}{60}$ which last 2. Numerators being added together doe make in all $\frac{131}{60}$ which is 2. Integrums and $\frac{11}{60}$.

Subtraction of Fractions.

HOw are Fractions to be Subtracted, one out of another, or out of Integrums?

First make the denominators like as you did before in Addition, then take the lesser Numerator out of the greater, and vnder the remainder thereof write the common denommator, so shall you finde that $\frac{3}{7}$ being taken out of $\frac{6}{7}$ there remaineth $\frac{3}{7}$ but if you would Subtract Fractions out of Integrums, then you must take one of the Integrums and breake it into partes. As for example, to Subtract $\frac{3}{7}$ out of 9. Integrums take one from 9. and breake it into parts making it $\frac{7}{7}$ for that is one Integrum, for whensoeuer the Numerator is made like and equall to the Denominator, it signifieth one Integrum, then take $\frac{3}{7}$ out of $\frac{7}{7}$ and there remaineth $\frac{4}{7}$ and 8. Integrums.

What is to be obserued in breaking the Integrum?

In breaking the Integrum, you are to be directed alwaies by the denominator of the Fraction which you haue to Subtract, for the Integrum which should be the Numerator, must be equall in value to the said denominator, as before is said.

Multiplication of Fractions.

HOw are Fractions to be Multiplyed by Fractions, or Integrums by Fractions?

As touching Fractions, Multiply the Numerator one into another, and the product thereof shall be the Numerator, then Multiply the denominators in like manner, & the product thereof shall be the denominator, so shall you find that $\frac{1}{3}$ being Multiplyed by $\frac{1}{4}$ doe make $\frac{1}{12}$. But if you would Multiply Integrums by Fractions, then Multiply the Integrums by the Numerator of the

the Fraction, and vnder the product thereof, set downe the denominator of the same Fraction, drawing a line betwixt them, so shal you finde that 20. integrums being Multiplyed by $\frac{1}{15}$ doe make $\frac{100}{15}$ that is to say 8. integrums and $\frac{4}{15}$ which is $\frac{1}{15}$ &c.

Division of Fractions.

HOw are Fractions to bee diuided by Fractions, or Integrums by Fractions, or Fractions by integrums?

The diuision of Fractions is done by Multiplycation thus, first set downe your diuidend on the left hand, and the Diuisor alwaies on the right hand, and then draw 2. crosse lines like a Saint Andrews crosse betwixt them which shall direct you in your worke: As for example, if you woulde diuide $\frac{2}{3}$ by $\frac{4}{5}$ set them downe thus $\frac{\text{dividend } \frac{2}{3}}{\text{divisor } \frac{4}{5}}$ & worke as followeth, first Multiply the Numerator of the diuidend, by the denominator of the Diuisor, and the product thereof shall be the Numerator, then Multiply the denominator of the diuidend, by the Numerator of the Diuisor, and that shall bee the denominator, so shall you finde that $\frac{2}{3}$ being diuided by $\frac{4}{5}$ there remaineth $\frac{10}{12}$ that is $\frac{5}{6}$ but if you would diuide Integrums by Fractions, or contrariwise Fractions by Integrums, then make of Integrums a Fraction, by setting downe 1. in the place of a denominator vnder the Integrums, and worke as before, so shall you finde that $\frac{7}{1}$ Integrums being diuided by $\frac{1}{4}$ doe make $\frac{28}{1}$ contrarily if you diuide $\frac{1}{4}$ by $\frac{7}{1}$ Integrums, there will arise $\frac{1}{28}$.

What if I haue to diuide Fractions annexed to Integrums?

Then you must first reduce each Integrum with his Fraction annexed, into one selfe Fraction by the fourth rule of Fractions, before taught. As for example, if you would diuide 9. Integrums hauing $\frac{1}{4}$ thereunto annexed, by 3. Integrums and $\frac{1}{4}$, here the fourth rule of Fractions teacheth you first to Multiply the Integrum 9. by 4. which is the Denominator of the Fraction annexed, the product whereof is 36. whereunto by adding the Numerator of the same Fraction which is 1. you shall make the Numera-

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tor of the dividend to be 39. vnder which you must set the denominator 4. thus $\frac{39}{4}$ and that is your whole dividend, then having in like manner brought the Diuisor which is 3. Integrums and $\frac{1}{4}$ into one selfe Fraction, worke as the former rule of Diuision teacheth you, and you shall produce $\frac{13}{4}$ which is 2. Integrums and $\frac{13}{40}$

The Rule of three belonging to *Fractions*.

Cap. 9.

WHat order is to be obserued in this Rule hauing to deale with Fractions onely?

The selfe same order that hath bene taught before touching Integrums: for in working with Fractions you must haue also 3. seuerall numbers, and you must see that the first and third numbers bee of one selfe Denomination, and that number is to be placed alwaies in the third place whereunto the question is annexed, and then to multiplie the second by the third, and to diuide by the first, and so the fourth number which you seeke to know, shall appeare: As for example if $\frac{3}{4}$ of an ell of fine Holland cost me $\frac{5}{6}$ of an English crowne, in value 15. groats, what shall $\frac{1}{6}$ of an ell cost me, here first you must set downe your 3. seuerall numbers in order thus, $\frac{3}{4}$ ell. $\frac{5}{6}$ ell. so as the first and third may bee one selfe denomination, then multiplie the second and third Fraction the one into the other, which will make $\frac{15}{24}$ and that being diuided by $\frac{3}{4}$ which is the first Fraction will produce $\frac{60}{72}$ of a Crowne, the value of which Fraction if you seeke to know by helpe of the first rule of Fractions, teaching you to Multiplie the Numerator of the Fraction, by the knowne parts of a crowne which are 5.s.or 15. groats, you shall finde the value of that Fraction to be 11. groats $\frac{6}{24}$ of a groat, which is one farthing and somewhat more, supposing the least knowne parts of a groat to be 16. farthings.

The

The Golden Rule reuerſe, called in *Latine regula euerſa, that is to ſay turned back-ward.*

Cap. 10.

WHat is the order of this rule?

Multiply the firſt by the ſecond, and diuide the product thereof by the third, as if a pennie Loafe muſt waigh 2.ℓ. Wheat being at 3.ſ. the buſhel, what ſhall a pennie Loafe waigh when Wheate is at 2.ſ. the buſhel, the queſtion muſt be framed thus, if 3.ſ. require 2.ℓ. waight, what ſhall 2.ſ. haue, then by working according to this rule, you ſhall finde that the pennie Loafe muſt waigh 3.ℓ.

Another example of the ſame rule.

I would know how many yardes of Bayes bearing in breadth ¾ will ſuffice to line 7. yardes of Silke bearing in breadth three quarters and a halfe. Here you muſt frame youre queſtion thus, if ¾ and ½ require 7. yards, what ſhall ⅞ require, but becauſe the firſt and third number of this queſtion are not of one ſelfe denomination by reaſon of the Fraction annexed to the firſt number, you ſhal doe well to reduce the firſt and third number both into halfe quarters, and then to worke as though they were all Integrums, which is more eaſie then to make all the numbers Fractions, wherefore ſay thus: If 7. halfe quarters doe require, 7. yardes, what ſhall 14. halfe quarters require, and in working by the Rule Reuerſe, you ſhall finde in the quotient 3. yards of Bayes and a halfe.

The

The double Rule called in Latine. *Regula duplex.*

Cap. 11.

WHere to serues this rule & what order is to be obserued therin?

This rule serueth to vnfolde two questiõs wrapt in one, as thus. If I pay 4. ß. for the carriage of 20. ℔. waight 30. miles, what shal I pay for the carriage of 50. ℔. waight 60. miles, here of this and such like demaundes, you must make two sundrie questions, and the fourth Summe of the first question being found, shall bee the second or middle number of the second questiõ, wherefore frame your first question thus, if 20. ℔. cost 4. ß. what shall 50. l. cost, and you shall finde that it wil cost you 10. ß. then say if 30. miles cost 10. ß. what shall 60. miles cost, and you shall finde that it will cost 20. ß. And note that each of these 2. questions is to be wrought by the common rule of three, that is to say, by Multiplying the second into the third, and by diuiding the product thereof by the first, and the fourth found number of the first question must be the second, or midle number of the second question, as in the former example, you se that 10. ß. which was the fourth found number, is here the middle number of the secons question.

Another Example.

If 25. ℔. doe gaine me 8. ℔. in 4. yeares, how much shall 100. ℔. win one in 10. yeares, both these questions are also to be wrought by the common rule of 3. Wherefore set downe the first question thus. if 25. ℔. yeldeth 8. ℔. what shall 100. ℔. yeld, and you shall finde 32. ℔. then say 4. yeares yeldeth 32. ℔. what shall 10. yeares yelde, and you shall find 80. ℔. But note that these dou-

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ble questions, may be put in such sort as you must worke the first or second question, sometimes by the rule reuerse. As in this question here following, if 6. l. win 8. Crownes in 10. yeares, in how many yeares shall 3. l. win 12. Crownes, here frame your first question thus, if 6. l. require 10. yeares, how many yeares shall 3 l. require: And in working this question by the rule Reuerse, you shall finde 20. yeares, then for the second question say thus, if 8. Crownes require 20. yeares, how many yeares shall 12. Crownes require: Here if you worke by the common rule of three, you shall finde 30. yeares.

Another Example.

If 7. horses doe eat 12. bushels of Oates in 20. daies, how many bushels shall 14. horses eat in 15. daies, here frame your first question thus, If 7. horses do eat 12. bushels, what will 14. horses eate, and in working by the common rule of three you shall finde in the quotient 24. bushels, then frame your question thus, if 20. daies require 24. bushels, what shall 15. daies require, here in working by the common rule of three you shall finde in the quotient 18. bushels.

Another Example.

If ten reapers reape 15. Acres in 7. daies, in how many daies shall 16. reapers reape 20. Acres: Here frame your first question thus, if 10. reapers require 7. daies, how many daies shall 16. reapers require, which question must be wrought by the rule Reuerse, and so you shall finde 4. daies and $\frac{1}{6}$ of a day which is 9. houres, then say, if 15. Acres require 4. daies and $\frac{1}{6}$ of a day, how many daies shall 20. Acres require, and in working this second question by the common rule of three belonging to Fractions as is before taught, you shal finde that 20. Acres will require 5. daies and $\frac{10}{12}$ $\frac{1}{6}$ of a day which is 20. houres. But it were more easie in this second question to reduce the daies into houres by Multiplying the 4. daies by 24. houres, the product whereof wil be 96. houres, whereunto if you adde the od 9. houres it will make in all 105. houres, which being Multiplied by the third number of this

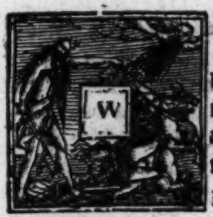
second question, which is 20. the product shall be 2100. houres, which diuided by the first number of the said question which is 15, you shall finde in the quotient 140. houres, which if you diuide againe by 24 you shall finde in the quotient 5. dayes, and the remainder to be 20. houres, which agreeth in all pointes with the first manner of working by Fractions, and is the easier way of the two.

How shall I know hauing to worke by this Double Rule, when to vse the Rule reuerse?

By considering whether the third number requireth more or lesse of time, or of any other measure or quantitie, as in the former example, of Bayes for lining, the more breadth it had, the lesse did serue for lining. Againe in the example of the gaine by yeares, of 6. l. and 3 l. you did see that 3. l. require more yeards then 6. l. and therefore that first question was wrought by the rule reuerse: Also in this last example of the reapers, the more reapers the lesse time they require, & therefore that question was wrought by the rule reuerse.

The Rule of Fellowship.

Cap. 12.



What doth this rule teach?

To knowe the gaine or losse of such as do make a stocke and doe occupie together in the trade of Marchandize: As for example, foure Marchants did put their mony in lot in this manner. The first brought 30. Crownes, the second 50. the third 60 and the fourth 100. and with these portions they gained 3000. Crownes, the question is how much euery one shall haue to his share of that gaine according to the portion which he brought. To know this, you must first gather all the seuerall portions together by Addition into one Summe, and you shal find the summe of the portions to be 240. Crownes, then say if 240. Crownes doe gaine 3000. Crownes, what shall 30. gaine

and

and after this manner worke by the common rule of 3. with all the rest of the portions, and so you shall finde that he which brought 30. ought to haue 375. Crownes, and he that brought 50. ought to haue 625. Crownes, and he that brought 60. ought to haue 750. Crownes, and he that brought 100. ought to haue 1250. which maketh in all 3000. Crownes, for that is the very summe of the gaine before set downe, the order of working whereof, this figure plainely sheweth.

240 ——— 3000 ——— { 30 — 375. / 50 — 625. / 60 — 750. / 100 — 1250.

The Common Diuisor which is the Summe of the particular portions added together. } the generall gaine. } the particular portions. } euery mans single share.

A like example of losse received by Shipwracke.

Three Marchants doe venture their goods in one Shippe, the goods of the first were worth 300. Crownes, the second 400. the third 500. there were as much goods cast out as was worth 100. Crownes, the question is how much euery one should lose according to his portion, here worke as before, and you shall finde that euery one shall lose so much as this figure following sheweth.

1200 ——— 100 ——— { 300 — 25. / 400 — 33. $\frac{1}{3}$. which is 5. groats. / 500 — 41. $\frac{2}{3}$. which is 10. groats.

The common diuisor which is the Sum of the particular portions added together. } the generall losse. } the particular portions. } euery mans seuerall losse

Here to know whether the 3. seuerall losses doe make vp the generall losse, doe thus, first adde the Integrums of the seuerall losses together, the Summe whereof will be 99. whereunto if you adde the 2. Fractions which doe make one whole Crowne,

the Summe will be 100. a number like vnto the generall losse.

Another Example.

Three Marchants haue bought 1000. l. of Pepper for 300. Crownes, the first taketh 200. l. the second 350. l. and the third 450. l. what shall euery man pay according to the portion which he hath receiued, then say if 1000. l. be worth 300. Crownes, what is 200. l. worth, here working by the common rule of 3. with euery mans seuerall portion receiued, you shall find that the first must pay 600. Crownes, the second 105. and the third 135. Crownes, as this figure here following sheweth.

	l		
1000	300	200	60.
		350	105.
		450	135.

The common Diuisor. The generall price. The seuerall portions receiued. euery mans particular paiment.

Another like example of diuers distance of time.

Three Marchants occupying together vis gaine 2345. Crownes, the first put in 40. Crownes for the space of 14. Moneths, the second put in 50. Crownes for the space of 8. Months, and the third put 85. Crownes for the space of 6. Moneths, the question is, how much euery one shall haue after the rate of his money, and according to the quantitie of time: This is to be wrought according to the rule of Fellowship thus, Multiply euery mans mony by his time, either of which, that is to say, the money and the time must be of one selfe denomination, then adde the Summes of those seuerall portions together, and the totall summe of such Addition shall be the first number, and the common gaine shall be the second number, and the third number shall be euery mans mony Multiplyed by his time, then in working by the common rule of 3. you shall finde that euery man shall haue such share as this figure here following sheweth.

1470 ——— 2345 ——— 560 ——— 893.$\frac{1}{7}$
400 ——— 638.$\frac{1}{11}$
510 ——— 813.$\frac{4}{7}$

The common Diuisor which is the totall Summe of the seuerall portions of money added together. } the generall Summe of the gaine. } the particular portions of the monymultiplied by his time. } euery mans single share.

Now if you woulde know whether the single shares in this example doe make vp the generall Summe of the gaine, then adde together the Integrums or whole Summes of euery mans single share, and you shall finde the Summe to bee but 2344, which wanteth one whole Integrum of the second or middle number of the question, which you shall easilie supply by adding the 3. seuerall Fractions together according to the rule of Addition of Fractions before taught, for so shall you finde the saide 3. Fractions to make in all one whole Integrum, which being added to 2344, will be answereable to the second number of the question, which as you see in the example is 2345. And remember in adding together the said 3. Fractions, to set them in this order $\frac{1}{7}/\frac{1}{11}/\frac{4}{7}$. and then to bring them to one selfe denomination, as the seuenth rule of Fractions teacheth you. But first because you shal find the 3. remainders after the first 3. Diuisions of the 3. seuerall portions, made by the first common Diuisor of the question to be written in many figures, you must set them downe in fewer figures according as the fifth rule of Fractions teacheth you, so shall you finde the first remainder containing $\frac{400}{1470}$ to be no more but $\frac{4}{7}$ and the second remainder containing $\frac{140}{1470}$ to be $\frac{1}{11}$ and the third remainder containing $\frac{14}{1470}$ to be $\frac{4}{7}$ which 3. Fractions being added together according to the seuenth rule of Fractions, will make $\frac{441}{441}$ which is one whole Integrum, and must be added by the name of 1 to the middle or second number of the question, as I haue saide before: you may also make vp the foresaide number by seeking to know the value of euery Fraction annexed to the Integrums, according as the sixt rule of Fractions teacheth, for so shall you finde the value of the first Fraction to be fiue groats, and the value of the second Fractiõ to be one groat 6. farthinges, and $\frac{3}{11}$ of a far-

thing, & you shall find the value of ỳ third Fraction to be 8. groats 9 farthings, and $\frac{1}{7}$ of a farthing, & if you adde $\frac{18}{21}$ & $\frac{1}{7}$ of a farthing to gether, you shall finde that it will make $\frac{147}{147}$ which is one whole Integrum or one whole farthing. Now if you adde 6. 9, and 1. farthings to gether, it will make iust 16. farthings, & that is 1. groat, which being added to ỳ 14. groats before found out, wil make in al 15. groats which is one Crowne, and that being added to the sum 23 44. will make it 2345. Crownes, which is a number agreeable to the middle Summe of the question. Truely if you exercise your selfe in this and such like questions, it will make you perfect not onely in Addition, Subtraction, Multiplycation, and Diuision of whole numbers, but also of Fractions, and almost in all the other rules belonging as wel to Fractions, as to Integrums. Wherefore I would wish you often to vse your penne therein.

Hauing hitherto treated of the 4. speciall kinds of Arithmeticke, that is of Addition, Subtraction, Multiplycation and Diuision, as well belonging to whole numbers, as to Fractions: and also shewed the vse of the Golden rule, otherwise called the rule of 3. and of all the three kinds thereof, that is the common rule, the rule Reuerse, and the Double rule, and giuen examples, how and when euery one is to be vsed, together with the rule of Fellowship, necessarie for them that vse any trade of Marchandize, I thinke good now to speake some what of Arithmeticall and Geometricall progression, and also of Proportion, and of the three kinds thereof, that is Arithmeticall, Geometricall, and Musicall proportion, and then of the extraction of Rootes both square and Cubicall, and last of all, of Astronomicall Fractions, shewing how they are to be added, Subtracted, Multiplyed and diuided.

Of Progression and how manifolde it is.

Cap. 13.

WHat is Progression?

It is a certaine order of proceeding with diuers numbers in such sorte as euery one may exceede each other, either by like difference of quantitie, or else by like-

likeneſſe of Proportion, whereof ſpringeth 2. kinds of Progreſſion, the one called Arithmeticall, and the other Geometricall.

What is Arithmeticall Progreſsion?

It is that which proceedeth by like difference of quantitie, as thus, 3.5.7.9. 11.13. whereof euery one exceedeth his fellow by the difference of 2.

What is Progreſsion Geometricall?

It is that wherein euery number exceedeth his fellow by like proportion, for as 6. containeth 3. twiſe, ſo doth 12. containe 6. twiſe, &c.

Of Addition belonging to Progreſſion Arithmeticall.

Cap. 14.

HOw are numbers being ſet in order according to Progreſsion Arithmeticall, to be added together and to be reduced into one totall ſumme?

Thus, firſt ſée how many ſeuerall numbers there be in all, and note the Summe by it ſelfe, then adde the firſt number of the Progreſſion to the laſt thereof, and note that Summe by it ſelfe, that done, Multiply the one of theſe 2. reſerued Summes by the one halfe of the other, and you ſhall haue the totall Summe. As for example, let theſe be your Progreſſion 6. 10. 14/18/22/26/30/34/ wherein euery number exceedeth his fellow by the difference of 4 here hauing tolde the numbers, I finde them to be 8. which I ſet downe by it ſelfe, then I adde 6. which is the firſt number to 34. which is the laſt, and the Summe thereof is 40. which I alſo ſet downe by it ſelfe, then in Multiplying 40. by 4. which is the one halfe of 8. before ſet downe apart by it ſelfe, I finde the totall Summe of the Progreſſion to be 160.

Of Addition belonging to progreſsion Geometricall.

Cap. 15.

HOw are numbers being ſet in order according to Progreſsion Geometricall, to be added and be brought into one Summe.

Thus, multiply the laſt Summe of the progreſſion by thenumber of the proportion whereby ſuch progreſſion proceedeth, and from the product of that multiplycation, ſubtract the firſt number of the progreſſion: that done, diuide that which remaineth by a number which is leſſe then the proportion by one, and the quotient of ſuch Diuiſion ſhall ſhew you the totall Summe of the ſaid progreſſion. As for example, let this be the progreſſion 2.6.18.54.162.486.1458. the proportion of which progreſſion is triple, wherefore according to the rule, I multiply the laſt number of the progreſſion by 3. and the product of ſuch Multiplycation amounteth to 4374. out of which Summe I ſubtract the firſt number which is 2. and there remaineth 4372. which I diuide by 2. (for it is leſſe then the proportion 3. by 1.) and ſo I finde in the quotient 2186. which is the totall Summe of the progreſſion Geometricall.

Is there no briefer way of adding ſuch kinds of progreſsiõ?

Yes indeede, but not ſo plaine as this way is, and therefore I thinke not good to trouble your memorie therewith.

Of Proportion.

Cap. 16.

WHat is Proportion?

Proportion is taken generally for the comparing of two diuers quantities or numbers together, ſhewing what likeneſſe is betwixt them. But before we deale

deale with Proportion, and with the three kindes thereof, that is Proportion, Arithmeticall, Geometricall, and Musicall: You haue first to vnderstand, that of numbers some are said to bee abstract, and some concrete.

The abstract are such as are not tyed to any denomination, and such as are twofold, that is absolute and relative.

The absolute, are simply pronounced without hauing any relation to any other number, measure or quantitie, as 2.3.4. &c. and all numbers whatsoeuer, that are without denomination and are not attributed to any other thing.

The relative are those which haue relatiō one to an other, which may be three manner of wayes. First in respect of difference which is found by Subtraction, secondly in respect of the quotient found by Diuision, thirdly in respect of both. Of the first way springeth Arithmeticall proportion: Of the second way Geometricall proportion: And of the third Musicall proportion.

Cap. 17.

WHat is Arithmeticall proportion?

Arithmeticall proportion vnproperly so called, (because it is no proportion indeed) is when many seuerall numbers haue one selfe and like difference, as 8.12.16. which doe onely differ one from another by 4. and this proportion is twofold, that is continuall and disiunct.

Continuall is when many numbers proceede with like difference, as hath beene said before when we spake of Arithmetical Progression, as 8 12.16.20.&c. whose difference betwixt euery 2. numbers is 4..

The Disiunct, is when many numbers being seuerally propounded, the difference of the first 2. numbers is not like to the difference that is betwixt the second and the third, and so forth as 5.8.4.7. for 8. differeth from 5. by 3. and 4. from 8. by 4. and 7. from 4 by 3. Now of the second way of comparing which is done by Diuision, springeth as hath beene said before, Geometricall proportion.

Cap. 18.

WHat is Geometricall proportion?

Geometricall proportion is that which sheweth what part or partes one number is of another number, as 3. is the halfe of 6. which proportion is found by Diuision, wherein you haue to note that if the Diuisor bee greater then the diuidend, then it is to be made a Fraction, as in the former example, if you would diuide 3. by 6. then you must make it a Fraction thus, $\frac{3}{6}$ or $\frac{1}{2}$ and this kind of proportion which may be truly and properly called a proportion indeed or rather a proportionalitie, is said to be twofold, that is, direct, and reuerse, and the direct is either Coniunct, or Disiunct.

Coniunct differeth not from Geometricall Progression before taught.

Disiunct proportion Geometricall, consisting most commonly of 4. numbers or of 3. at the least, is when there is not like proportion betwixt the second and the third, that is betwixt the first and the second, or betwixt the third and the fourth, as 3. 6. 4. 8. for here 6. containeth 4. once, and one halfe thereof, which is called Proportio Sesquialtera, and 6. containeth 3. twise, which is called Proportio dupla: and so is 8. to 4.

Cap. 19.

AGaine, proportion Reuerse differeth not from the rule of 3. called Regula euersa. But you haue to vnderstand that the two chiefe and speciall kinds of Geometricall proportion, are these, that is, proportion of equalitie, and proportion of inequalitie.

Proportion of equalitie, is when 2. numbers compared together, are equall the one to the other, as 3. to 3. 4. to 4.

The proportion of inequalitie, is when 2. vnequal numbers are compared together, as 6. to 5. 4. to 9. and of this there are two

kindes

kinds, that is proportion of the greater inequalitie, and proportion of the lesser inequalitie.

Cap. 20.

PRoportion of the greater inequalitie, is when the greater number is compared to the lesser number, as 6. to 5.

Proportion of the lesser inequalitie, is when the lesser is compared to the greater, as 5. to 6.

Of proportion of the greater inequalitie there bee two kinds, Simplex and Multiplex, that is to say, simple and manifold.

SImpler, is when the Antecedent, that is to say the former number containeth the consequent, that is to say, the latter number once and somewhat more, which overplus must alwaies bee lesse then the consequent it selfe, as 5 containeth 4. once and one part thereof more, for if you divide 5. by 4. the quotient will be 1. and $\frac{1}{4}$ over. Againe this proportion is two folde, that is Superparticular, and Superpartient, Superparticular, is when the Antecedent containeth the consequent once and some one part thereof, as 3. to 2. for 3. containeth 2. once and one halfe thereof, which is called Sesquialtera, or as 4. to 3. for 4. containeth 3. once and one third part thereof, and is called Sesquitertia., the like is to be said of Sesquiquarta, Sesquiquinta, Sesquisexta, and so forth infinitely as this Table sheweth.

Superparticular proportiós are these & such like.	Sesquialtera as 3. to 2. 6. to 4. 9. to 6.	which is as much as	$1\frac{1}{2}$
	Sesquitertia as 4. to 3. 8. to 6. 12. to 9.		$1\frac{1}{3}$
	Sesquiquarta as 5. to 4. 10. to 8. 15. to 12.		$1\frac{1}{4}$
	Sesquiquinta as 6. to 5. 12. to 10. 18. to 15		$1\frac{1}{5}$
	Sesquisexta as 7. to 8. 14. to 12. 21, to 18		$1\frac{1}{6}$
	Sesquiseptima as 8. to 7. 16. to 14. 24. to 21		$1\frac{1}{7}$
	Sesquioctaua as 9. to 8. 18. to 16. 27, to 24		$1\frac{1}{8}$
	Sesquinona as 10. to 9. 20. to 18. 30. to 27		$1\frac{1}{9}$
	Sesquidecima as 11. to 10. 22. to 20. 33. to 30		$1\frac{1}{10}$
	Sesquiūdeci. as 12. to 11. 24. to 22. 36. to 33		$1\frac{1}{11}$
	Sesquiduodeç. as 13. to 12. 26. to 24. 39. to 36		$1\frac{1}{12}$

But

But superpartient is when the Antecedent containeth the consequent once and some parts thereof, that is to say, more parts then one, as 5. to 3. for 5. containeth 3. once and 2. third parts thereof, which is called Superbipartiens tertias, of which kinds are these set downe in the Table following.

Superbipartiens.	Tertias as 5. to 3. 10. to 6. 15. to 9.	which is as much as.	$1\frac{2}{3}$
	Quintas as 7. to 5. 14. to 10. 21. to 15.		$1\frac{2}{5}$
	Septimas as 9. to 7. 18. to 14. 27. to 21.		$1\frac{2}{7}$
	Nonas as 11. to 9. 22. to 18. 33. to 27.		$1\frac{2}{9}$
	Vndecimas as 13. to 11. 26. to 22. 39. to 33.		$1\frac{2}{11}$
	Decim. tertias as 15. to 13. 30. to 26. 45. to 39.		$1\frac{2}{13}$
Supertripartiens	Quartas as 7. to 4. 14. to 8. 21. to 12.	which is as much as	$1\frac{3}{4}$
	Quintas as 8. to 5. 16. to 10. 24. to 15.		$1\frac{3}{5}$
	Septimas as 10. to 7. 20. to 14. 30. to 21.		$1\frac{3}{7}$
	Octauas as 11. to 8. 22. to 16. 33. to 24.		$1\frac{3}{8}$
	Decimas as 13. to 10. 26. to 20. 39. to 30.		$1\frac{3}{10}$
	Vndecmas as 14. to 11. 28. to 22. 24. to 33.		$1\frac{3}{11}$
Superquadripartiens	Quintas as 9. to 5. 18. to 10. 27. to 15.	which is as much as	$1\frac{4}{5}$
	Septimas as 11. to 7. 22. to 14. 33. to 21.		$1\frac{4}{7}$
	Nonas as 13. to 9. 26. to 18. 49 to 27.		$1\frac{4}{9}$
	Vndecimas as 15. to 11. 30. to 22. 45. to 33.		$1\frac{4}{11}$
	Decim. tertias as 17. to 13. 34. to 26. 51. to 39.		$1\frac{4}{13}$
	Decim. quintas as 19. to 15. 38. to 30. 57. to 45		$1\frac{4}{15}$
Superquintupartiens.	Sextas as 11. to 6. 22. to 12. 33. to 18.	which is as much as	$1\frac{5}{6}$
	Septimas as 12. to 7. 24. to 14. 36. to. 21.		$1\frac{5}{7}$
	Octauas as 13. to 8. 26. to 16. 39. to. 24.		$1\frac{5}{8}$
	Nonas as 14. to 9. 28. to 18. 42. to 27.		$1\frac{5}{9}$
	Vndecimas as 16. to 11. 32. to 22. 48. to 33.		$1\frac{5}{11}$
	Duodecimas as 17. to 12. 34. to 24. 51. to 36.		$1\frac{5}{12}$
Supersextupartiens.	Septimas as 13. to 7. 26. to 14. 39. to 21.	which is as much as	$1\frac{6}{7}$
	Vndecimas as 17. to 11. 34. to 22. 51. to 33.		$1\frac{6}{11}$
	Decim. tertias as 19. to 13. 38. to 26. 57. to 39.		$1\frac{6}{13}$
	Decim. septim. as 23. to 17. 46. to 34. 60. to 51.		$1\frac{6}{17}$
	Decim. nonas as 25. to 19. 50. to 38. 75. to 57.		$1\frac{6}{19}$
	Vicesimas tertias as 29. to. 23. 58. to 46.		$1\frac{6}{23}$

Superpartiens superpartientes are these and such like.

Hitherto

Hitherto of Simplex proportio. Now of Multiplex proportio.

Multiplex proportio is when the Antecedent containeth the consequent more then once, as 6. to 2. for 6 containeth 2. three times, which is called Tripla proportio. Also 12. to 5. for 12. comprehendeth 5. twise and $\frac{2}{5}$. And this Multiplex proportio is twofolde, that is either exact or not exact.

Multiplex exact, is when the Antecedent containeth the consequent more then once, and nothing remaineth, as 4. to 2. 6 to 3. &c. whereof are infinite kinds as Dupla, Tripla, and so forth as this Table sheweth.

The kinds of Multiplex exact are these and such like.	Dupla as 4. to 2. 6. to 3. 8. to 4.	which is as much as.	$\frac{2}{1}$ $\frac{3}{1}$ $\frac{4}{1}$ $\frac{5}{1}$ $\frac{6}{1}$ $\frac{7}{1}$ $\frac{8}{1}$ $\frac{9}{1}$ $\frac{10}{1}$ $\frac{11}{1}$ $\frac{12}{1}$
	Tripla as 6. to 2. 9. to 3. 12. to 4.		
	Quadrupla as 8. to 2. 12. to 3. 16. to 4.		
	Quintupla as 10. to 2. 15. to 3. 20. to 4.		
	Sextupla as 12. to 2. 18. to 3. 24. to 4.		
	Septupla as 14. to 2. 21. to 3. 56. to 8.		
	Octupla as 16. to 2. 24. to 3. 32. to 4.		
	Nondupla as 18. to 2. 27. to 3. 36. to 4.		
	Decupla as 20. to 2. 30. to 3. 40. to 4.		
	Vndecupla as 22. to 2. 33. to 3. 495. to 45		

But Multiplex not exact, is when the Antecedent containeth the consequent more then once and some thing remaineth ouer, as 5. to 2. for 5. containeth 2. twise and one remaineth, and this is also twofolde, that is, Multiplex superparticularis, and Multiplex superpartiens.

Multiplex superparticularis, is when the Antecedent containeth the consequent more then once and one only remaineth, as 7. to 3. for 7 containeth 3. twise and one only remaineth, whereof are diuers kinds, as Duplex sesquialtera, Duplex sesquitertia, Triplex sesquisexta, & so forth as ỳ table hereafter following sheweth.

But Multiplex superpartiens is when the Antecedent containeth the consquent more then once & the remainder is more then 1. as 8. to 3. for 8. containeth 3. twise and 2. thirds ouer, whereof there be many kinds, as Dupla superbipartiens tertias, Dupla supertripartiens quartas, and so forth as this Table following sheweth, which comprehendeth both kinds, that is Multiplex superparticularis, and Multiplex superpartiens.

Multiplex

But superpartient is when the Antecedent containeth the consequent once and some parts thereof, that is to say, more parts then one, as 5. to 3. for 5. containeth 3. once and 2. third parts thereof, which is called Superbipartiens tertias, of which kinds are these set downe in the Table following.

Superbipartiens.	Tertias as 5. to 3. 10. to 6. 15. to 9.	which is as much as.	$1\frac{2}{3}$
	Quintas as 7. to 5. 14. to 10. 21. to 15.		$1\frac{2}{5}$
	Septimas as 9. to 7. 18. to 14. 27. to 21.		$1\frac{2}{7}$
	Nonas as 11. to 9. 22. to 18. 33. to 27.		$1\frac{2}{9}$
	Vndecimas as 13. to 11. 26. to 22. 39. to 33.		$1\frac{2}{11}$
	Decim. tertias as 15. to 13. 30. to 26. 45. to 39.		$1\frac{2}{13}$
Supertripartiens.	Quartas as 7. to 4. 14. to 8. 21. to 12.	which is as much as	$1\frac{3}{4}$
	Quintas as 8. to 5. 16. to 10. 24. to 15.		$1\frac{3}{5}$
	Septimas as 10. to 7. 20. to 14. 30. to 21.		$1\frac{3}{7}$
	Octauas as 11. to 8. 22. to 16. 33. to 24.		$1\frac{3}{8}$
	Decimas as 13. to 10. 26. to 20. 39. to 30.		$1\frac{3}{10}$
	Vndecmas as 14. to 11. 28. to 22. 24. to 33.		$1\frac{3}{11}$
Superquadripartiens	Quintas as 9. to 5. 18. to 10. 27. to 15.	which is as much as	$1\frac{4}{5}$
	Septimas as 11. to 7. 22. to 14. 33. to 21.		$1\frac{4}{7}$
	Nonas as 13. to 9. 26. to 18. 49 to 27.		$1\frac{4}{9}$
	Vndecimas as 15. to 11. 30. to 22. 45. to 33.		$1\frac{4}{11}$
	Decim. tertias as 17. to 13. 34. to 26. 51. to 39.		$1\frac{4}{13}$
	Decim. quintas as 19. to 15. 38. to 30. 57. to 45		$1\frac{4}{15}$
Superquintupartiens.	Sextas as 11. to 6. 22. to 12. 33. to 18.	which is as much as	$1\frac{5}{6}$
	Septimas as 12. to 7. 24. to 14. 36. to. 21.		$1\frac{5}{7}$
	Octauas as 13. to 8. 26. to 16. 39. to. 24.		$1\frac{5}{8}$
	Nonas as 14. to 9. 28. to 18. 42. to 27.		$1\frac{5}{9}$
	Vndecimas as 16. to 11. 32. to 22. 48. to 33.		$1\frac{5}{11}$
	Duodecimas as 17. to 12. 34. to 24. 51. to 36.		$1\frac{5}{12}$
Supersextupartiens.	Septimas as 13. to 7. 26. to 14. 39. to 21.	which is as much as	$1\frac{6}{7}$
	Vndecimas as 17. to 11. 34. to 22. 51. to 33.		$1\frac{6}{11}$
	Decim. tertias as 19. to 13. 38. to 26. 57. to 39.		$1\frac{6}{13}$
	Decim. septim. as 23. to 17. 46. to 34. 60. to 51.		$1\frac{6}{17}$
	Decim. nonas as 25. to 19. 50. to 38. 75. to 57.		$1\frac{6}{19}$
	Vicesimas tertias as 29. to. 23. 58. to 46.		$1\frac{6}{23}$

Hitherto

Superpartientes quinquagesimas primas, & such like.

hitherto of Simplex proportio. Now of Multiplex proportio.

Multiplex proportio is when the Antecedent containeth the consequent more then once, as 6. to 2. for 6. containeth 2. three times, which is called Tripla proportio. Also 12. to 5. for 12. comprehendeth 5. twise and $\frac{2}{5}$. And this Multiplex proportio is twofolde, that is either exact or not exact.

Multiplex exact, is when the Antecedent containeth the consequent more then once, and nothing remaineth, as 4. to 2. 6. to 3. &c. whereof are infinite kinds as Dupla, Tripla, and so forth as this Table sheweth.

The kinds of Multiplex exact are these and such like.

Dupla as 4. to 2.	6. to 3.	8. to 4.
Tripla as 6. to 2.	9. to 3.	12. to 4.
Quadrupla as 8. to 2.	12. to 3.	16. to 4.
Quintupla as 10. to 2.	15. to 3.	20. to 4.
Sextupla as 12. to 2.	18. to 3.	24. to 4.
Septupla as 14. to 2.	21. to 3.	56. to 8.
Octupla as 16. to 2.	24. to 3.	32. to 4.
Nondupla as 18. to 2.	27. to 3.	36. to 4.
Decupla as 20. to 2.	30. to 3.	40. to 4.
Undecupla as 22. to 2.	33. to 3.	495. to 45

which is as much as.

$\frac{2}{1}$ $\frac{3}{1}$ $\frac{4}{1}$ $\frac{5}{1}$ $\frac{6}{1}$ $\frac{7}{1}$ $\frac{8}{1}$ $\frac{9}{1}$ $\frac{10}{1}$ $\frac{11}{1}$ $\frac{1}{1}$

But Multiplex not exact, is when the Antecedent containeth the consequent more then once and some thing remaineth ouer, as 5. to 2. for 5. containeth 2. twise and one remaineth, and this is also twofolde, that is, Multiplex superparticularis, and Multiplex superpartiens.

Multiplex superparticularis, is when the Antecedent containeth the consequent more then once and one only remaineth, as 7. to 3. for 7 containeth 3. twise and one only remaineth, whereof are diuers kinds, as Duplex sesquialtera, Duplex sesquitertia, Triplex sesquisexta, & so forth as ỹ table hereafter following sheweth.

But Multiplex superpartiens is when the Antecedent containeth the consquent more then once & the remainder is more then 1. as 8. to 3. for 8. containeth 3. twise and 2. thirds ouer, whereof there be many kinds, as Dupla superbipartiens tertias, Dupla supertripartiens quartas, and so forth as this Table following sheweth, which comprehendeth both kinds, that is Multiplex superparticularis, and Multiplex superpartiens.

Multiplex

- Multiplex Superparticularis or else
  - Duplex,
    - Sesqualtera as 5. to 2. 15. to 6.
    - Sesquitertia as 7. to 3. 21. to 9.
    - Sesquiquinta as 11. to 5. 22. to 10.
  - Triplex.
    - Sesquisexta as 19. to 6. 38. to 12.
    - Sesquiseptima as 22. to 7. 44. to 14.
    - Sesquioctaua as 25. to 8. 50. to 16.
  - Quadruplex.
    - Sesquinona as 37. to 9, 148. to 36.
    - Sesquidecima as 41. to 10, 82. to 20.
    - Sesquiundecima as 45. to 11, 90. to 22.

which is. $2\frac{1}{2}$ $2\frac{1}{3}$ $2\frac{1}{7}$ $3\frac{1}{7}$ $3\frac{1}{7}$ $3\frac{1}{8}$ $4\frac{1}{9}$ $4\frac{1}{10}$ $4\frac{1}{11}$

- Multiplex Superpartiens.
  - Dupla.
    - Superbipartiens.
      - Tertias as 8. to 3.
      - Quintas as 12. to 5.
    - Supertripartiens.
      - Quartas as 11. to 4.
      - Quintas as 13. to 5.
    - Superquadripartiens
      - Quintas as 14. to 5.
      - Septimas as 18. to 7.
  - Tripla.
    - Superquintupartiens.
      - Octauas as 29. to 8.
      - Nonas as 34. to 9.
    - Superseptupartiens:
      - Octauas as 31. to 8.
      - Nonas as 34. to 9.
    - Supersextupartiens.
      - Vndecimas as 39. to 11.
      - Decim. tertias as 45. to 13.
  - Quadrupla.
    - Superbipartiens.
      - Tertias as 14. to 3.
      - Quintas as 22. to 5.
    - Superquadripartiens
      - Quintas as 24. to 5.
      - Nonas as 40. to 9.
    - Superquintupartiens.
      - Sextas as 29. to 6.
      - Septimas as 33. to 7.

which is. $2\frac{2}{3}$ $2\frac{2}{5}$ $2\frac{4}{7}$ $2\frac{3}{5}$ $2\frac{4}{5}$ $2\frac{4}{7}$ $3\frac{5}{8}$ $3\frac{5}{9}$ $3\frac{6}{11}$ $3\frac{6}{13}$ $3\frac{7}{8}$ $3\frac{7}{9}$ $4\frac{2}{3}$ $4\frac{2}{5}$ $4\frac{4}{7}$ $4\frac{4}{9}$ $4\frac{5}{6}$ $4\frac{5}{7}$

Thus much of proportion of the greater inequalitie: Now we will speake somewhat of proportion of the lesser inequalitie.

Proportion

Cap. 21.

PRoportion of the lesser inequalitie, is when the Antecedent is lesse thē the consequent, as 2. to 3. 5. to 7. for if you diuide 2. by 3. the quotient is $\frac{2}{3}$. if 5. by 7 then the quotient is $\frac{5}{7}$ & this Proportion hath the same names which the Proportion of the greater inequalitie hath, saning that you must adde to the beginning of euery name, this word, Sub. as Subdupla, Subtripla, Subsesquialtera, &c. as 1. to 2. is Subdupla proportio, 3. to 9. is Subtripla proportio, &c.

Of Musicall proportion called in Latine *Harmoniaca proportio.*

Cap. 22.

MUsicall proportion which requireth 3. numbers at the least, is when the first number hath the same proportion vnto the third, which the difference betwixt the first and the second, hath to the difference which is betwixt the second and the thirde, as 3. 4. and 6. for loke what proportion 3. hath to 6. which is Subdupla, the same hath the difference betwixt 3. and 4 which is 1. to the difference betwixt 4. and 6. which is 2. for 1. to 2. is Subdupla, and this is called Musicall proportion, because the numbers therein haue the same proportions one to another, which are found to be in Musicall consorts, as 6. 4. and 3. for the proportion which 6. hath to 4. is Sesquialtera, called of the musitians Diapente, or a fifth, and the proportion which 4. hath to 3. is Sesquitertia, called of the musitians Diatesseron, or a fourth, and the pro-

proportion which 6. hath to 3. is Dupla, called a Diapason, or an Eight, and of this Musicall proportion there be two kinds, that is simple and compound.

It is said to be simple when it consisteth onely of 3. numbers. And it is called compound when it consisteth of more then 3. numbers: And of compound there be two kinds, that is unproper and proper.

The unproper is, when to 3. numbers given, 2 other severall numbers are ioyned, which doe containe the same proportions with the third, which the first 3. numbers, haue one to another: As for example, let be given these 3. numbers, 3.4.6. unto which if you ioyne 8. and 12. here 6.8.12. haue the same proportion one to another which 3.4. and 6. haue amongst them selues, for like as here betwixt 6. and 8. the proportion is Subsesquitertia, and betwixt 6. and 12. it is Subdupla, and betwixt 8. and 12. it is Subsesquialtera, so betwixt 3. and 4. is Subsesquitertia, and betwixt 3. and 6. is Subdupla, and betwixt 4. and 6. is Subsesquialtera.

Compound proper, is when diuers numbers in Musicall proportion standing together, and the first being omitted, the 3. next doe continue still in Musical proportion. Also when omitting the 2. first numbers the 3. next following are in Musicall proportion. And when omitting the first 3. the next 3. are in Musicall proportion, and so forth how many numbers so euer there be: As for example 10.12.15.20.30. these are numbers belonging to the proper kind of compound Musicall proportion, for 10. 12. and 15. are in Musicall proportion, then omitting 10. which is the first number 12. 15. and 20. are still in Musicall proportion, and if you omit the 2. first numbers, that is 10. and 12. then the next 3. that is 15. 20. and 30. are still in Musicall proportion, and so forth how many so euer there be of them, so as they be in Musical proportion: But our Musitians doe make no more but 8. Musicall proportions in all, that is.

Dupla

Dupla.	which are thus named	Diapason.
Tripla.		Diapason diapente.
Quadrupla.		Bis diapason.
Sesquialtera.		Diapente.
Sesquitertia.		Diatesseron.
Sesquiquarta.		Diatonus semitonus.
Dupla superbipartiens.		Diapason diatesseron.
Sesquioctaua.		Tonus.

The vse whereof is to be learned at the handes of the Musicians.

Cap: 23.

But now because it is not inough to know the foresaid proportions and their names, vnlesse you can both adde, Subtract, multiply, and diuide them when nede is, I will therefore briefly here set downe the order thereof, and first shew how to set them downe in writing, and then how they are to be added, Subtracted, multiplyed, and diuided.

They are to be set downe in writing in like manner that Fractions are wont to be set downe, sauing that as in Fractions the vpper number is called Numerator, and the inferior number Denominator, so in proportions the vpper number is called Antecedent, and the inferior number Consequent, but whereas in Fractions, there is wont to be drawn a litle line betwixt ỹ Numerator and the Denominator, in proportions no line is drawne betwixt the Antecedent & the Consequent, but the Antecedent is set ouer the Consequent, without any line drawne betwixt them thus.

And loke as Fractions are to be written in as fewe figures as may be, so are proportions to be set downe in 3.|4.|2.| so small numbers as may be, which is to be done by the 5.|7.|1.| selfe same rule that Fractions are.

Againe the order of adding, Subtracting, multiplying and diuiding of proportions is much like to that of Fractions, saving that

that the adding of proportions is to be done in ſuch manner as Fractions are to be multiplyed, and the Subtracting of proportions is like to the Diuiſion of Fractions, wherefore I wholly referre you to the rules of Fractions before moſt plainely taught, and ſo I end with proportions.

Notwithſtanding I had almoſt forgotten to ſet downe one neceſſarie Rule more touching proportions, which was alſo omitted in the firſt Impreſſion, that is, how to find out the meane proportionall number betwixt any two numbers giuen, which Rule is thus, multiply the two numbers giuen the one by the other, & the ſquare Roote of the product ſhall be the meane proportionall number betwixt them. As for example, ſuppoſe the two numbers giuen to be 9. and 36. which being multiplyed the one into the other, the product will be 324. the ſquare Roote whereof is 18. and that is the meane proportionall number betwixt the foreſaid numbers giuen. Now how to take the ſquare Roote of any number is plainly taught in the 24. Chapter next following.

How to finde out the ſquare Roote of any number.

Cap. 24.

WHat is a ſquare Roote?

It is any Digit or any other number, which being multiplyed into it ſelfe bringeth forth a ſquare number, as 4 being multiplyed in it ſelfe, in ſaying 4. times 4. maketh 16. which is a ſquare number, the Roote whereof is 4. And to finde out the ſquare Roote of any number be it ſquare or not ſquare, you muſt doe thus. Firſt hauing ſet downe the number propounded which muſt conſiſt of three figures at the leaſt, ſet a pricke vnder the firſt Digit or Cypher of the ſaid number on the right hand, that done, pricke euery other figure thereof towards the left hand, leauing alwaies one voide ſpace betwixt euery 2. pricks as you ſee here done in this

number

number 4.? ?.4.? and loke how many pricks there be, so many figures shall you haue in the quotient, and this differeth nothing in a manner from Diuision, the order in working is thus, first seke out a Digit, which being multiplyed in it selfe, may take away that which standeth ouer the last pricke on the left hand, or as much thereof as may be, and set the Digit in the quotient, that done, double the said quotient, then consider whether the double doe consist of one figure or of many, if of one onely, then place that in the next voide space on the right hand, but if the double doe consist of many figures, then take the first figure thereof, that is to say, that figure or Cypher which standeth in the first place of the double, and place that in the foresaid next voide space towards the right hand, and next to that, place all the rest of the figures of the said double orderly towards the left hand, that done, seke another Digit, which being multiplyed in it selfe together with the doubled number, may take away all that which standeth right ouer it, or as much thereof as may be, which Digit you must not onely put in the quotient to his fellow, but also set downe the same right vnder the next pricke on the right hand, and then multiply that Digit together with the double whereto it is ioyned, by the said last found Digit set downe in the quotient, the product whereof you must subtract out of the vpper number, standing right ouer the foresaid pricke, & if there be any remainder, write it aboue, cancelling the other, and loke how many pricks there be, so many times must you double ỹ quotient, obseruing alwaies like order of working as before, which you shall more plainely vnderstand by these examples following, and for your better vnderstanding thereof, I will first giue you an example of 3. figures onely as thus, 464. here to finde out the square roote of this number, you must first pricke the said number in such order as is before taught, and then seke out some one of the 9. Digits, which being multiplyed in it selfe, may take away the first 4. on the left hand, or as much therof as may be, which you shall finde to be 2. which 2. being set in the quotient, multiply the same in it selfe, in saying 2. times 2. maketh 4. which 4. doth cleane take away the first 4 standing ouer the last pricke on the left hand, and therefore cancell the 4. that done, double the quotient which maketh 4. and set the same in the next voide space on the right hand vnder the figure 6. thus.

And then ſeeke out ſome Digit, which being multi- 464 (2
plyed in it ſelfe together with the doubled, may take · 4 ·
away the Summe of 64. that remaineth, which by aſ-
king how many times 4. is comprehended in 6. you ſhall finde to
be but one, which you muſt not onely put in the quotient, but alſo
ſet it downe vnder the firſt pricke on the right hand thus.

So as you ſhall make the lower Summe to be 41. 464 (21.
which is to be multiplyed by the laſt found quotient · 41
which is 1. wherefore you muſt ſay that 1. times 41.
is 41. which being taken out of 64. there remaineth 23. ſo as the
rote is 21. and the remainder 23. as the example ſheweth.

And to know whether you haue done well or not, 23
multiply the quotient in it ſelfe, and if there be any 464 (21.
remainder left, adde that vnto the product of the · 41 ·
multiplyed quotient, and if you finde the ſumme thereof to be like
to the firſt, then you haue done well, if it be not like, then you haue
erred, the product of this quotient being multiplyed in it ſelfe a-
mounteth vnto 441. whereto by adding the remainder which is
23. you ſhall finde the ſumme to be like vnto the firſt number that
is 464. whereof you ſought the ſquare rote. But if ſuch number
doe conſiſt of many figures, then in working you muſt double the
quotient once, twice or thrice, according as the number doth re-
quire, as you ſhall more plainely perceiue by this example follow-
ing: as let 50467. be the number whereof you would know the
ſquare roote, here hauing pricked this number in ſuch order as be-
fore, firſt ſeeke out ſom Digit, which being multiplyed in it ſelfe
may take away the Digit or number ſtanding right ouer the laſt
pricke on the left hand, which you ſhall finde to be 2. and hauing
ſet downe the ſaid 2. in the quotient, ſay 2. times 2. maketh 4.
which being ſubtracted from 5. there remaineth 1. which you
muſt ſet ouer 5. and cancell the ſaid 5. as this example ſhew-
eth.

That done, double the quotient which maketh 1
4. and ſet downe the 4. in the next ſpace towards 50467 (2
the right hand, vnder the Cypher as you ſee in the · 4 · ·
former example, then ſeeke out a Digit, which being multiplyed
in it ſelfe together with the double quotient, may take away all
that which ſtandeth ouer the ſecond pricke towards the left hand,

or

or as much thereof as may be, which Digit by asking how many times 4. is comprehended in 10. you shall finde to bee 2. then set downe the saide 2. not onely in the quotient, but also vnder the second pricke towardes the right hande, which together with the former 4. maketh 42. as you see in this example.

Then Multiplie that 42. in a place by it selfe by the figure 2. last set downe in the quotient, and it will make 84. which 84. being taken out, of 104. there remaineth 20. which you must set ouer the second pricke and cancell the 104. and also the 42 beneath, as you see in the former example: that done, double the whole quotient, which maketh 44 whereof set the first 4 in the next voide space towards the right hand vnder the figure 6 and the other vnder the second pricke towards the left hand, then aske how many times 4 is comprehended in 20 and you shall finde 4, which you must not onely set downe in the quotient, but also vnder the nert and last pricke on the right hand, and so the nether Summe shall be 444. which being multiplied by the Digit 4 last set downe in ỹ quotient, will make in al 1776 which being taken out of the vpper number which is 2067, there will remaine 291, so as the square roote of the first numbers is 224 & theremainder 291, as you may see in this example.

```
                X 20
5 0 4 6 7 (22
  · 4 X ·
  ------
    84.
```

```
                X 2
X X 8 9 1
5 0 4 6 7 (224
·   ·   4
4 X 4
    4
  ------
  1776
```

The square roote whereof being multiplied in it selfe amounteth vnto 50176 wherto if you adde the remainder which is 291. the Summe thereof will bee like vnto the first number which is 50467 Moreouer you haue to note that if you find any number out of the which your quotient being doubled cannot be subtracted, then you must set downe a Cypher in the quotient, and proceede to the next pricke on your right hand, as in this example following.

```
                3 6 6 0 2 5 .(6
                ·   ·   ·
```

In which example the first found Digit set in the quotient is 6 which being multiplied in it selfe maketh 36 and cleane taketh away the first number standing ouer the last pricke on the left hand, that done, I double the quotient, which maketh 12 and I place the 2 in the next voide space towardes the right hand, and the 1 next to that towardes

the left hand orderly as in this example.

Ouer which 12. there is but 6. remaining, so as I can not take 12. out of 6. and therefore I cancell the 12. and set downe a Cypher in the quotient, so as the quotient is now 60. which being doubled maketh 120. the Cypher whereof I set downe in the next voide space towards the right hand, and the other two Digits orderly towards the left hand, as you sée in this example.

Then I aske how many times one is contained in 6. and I finde 5. which I set downe in the quotient and also vnder the last pricke on the right hand, so as the nether number is 1205. which I multiply apart by it selfe by the 5. last set downe in the quotient, the product whereof is 6025. which being taken out of the vpper number, which is also 6025. there remaineth nothing, as this example sheweth.

Wherefore I finde the foresaid number to be a iust square number, the roote whereof is 605. which, being multiplied in it selfe maketh 366025. a number like vnto the first number.

The vse of the square Roote in *setting of battels.*

Cap. 25.

The knowledge of finding out the square roote of any number, is very necessarie for a Sargent maior in the field, that he may the more readily set and range his Squadrones of battel: And therefore I thinke it not amisse, to giue them here certaine examples of such manner of squares as the Italians were wont to vse in my time which is foure manner of waies.

Whereof the first teacheth how to set the Battell square of ground

ground, the ſecond a ſquare battell of men, the third a long ſquare battell which we call the Hearſe battell, and the fourth teacheth how to ſet a battell of ſo much and a third.

Shew by what rule theſe battels are to be ſet.

Before I ſet downe any rules, you haue to vnderſtand that all numbers giuen or ſuppoſed, are not méete for ſuch purpoſe, but onely ſuch as may be diuided into 3. equall parts without leauing any remainder: for otherwiſe all the rules following, take no place, and therefore when any number is giuen you to be brought into any one of the foreſaid 4. formes of battell, you ſhall doe well firſt to diuide that number by 3. and if there be any remainder, to reiect it, and to take the reſt for your number. As for example, A Sargeant Maior is commanded by his Generall to ſet a battell ſquare of ground, appointing him thereunto 1345. men, here the Sargent by diuiding that number by 3. findeth in the remainder one man too many, which being onely reiected, all the reſt of the number which is 1344. is fit for his purpoſe.

How to ſet a battell ſquare of ground, called in Italian Battaglia quadra di terreno.

NOw ſhew the order of ſetting ſuch kinds of battell?

The order is thus, firſt double the number giuen, then take the ſquare roote thereof, and that roote ſhall be the Front: that done, diuide the number giuen by the ſaid roote, and the number in the quotient ſhall be the flanke, now if you multiply the front and the flanke the one into the other, you ſhall haue your whole number firſt giuen, vnleſſe there be ſome remainder left in the former Diuiſion, which remainder muſt be added to the product to make vp the Summe. But if you would know how many men are to be put in a ranke, and alſo how many ſuch ranks you muſt haue, then diuide the front into 3. partes, and the quotient will ſhew you how many men you are to haue in a ranke, that done, multiply the flanke by 3. and the product thereof ſhall be the number of the ranckes: As for example, take the number before giuen, which was 1345. which being diuided by 3. you find the remainder to be 1. which you muſt reiect, and take all the reſt which is

1344. and that being doubled maketh 2688. the ſquare Roote whereof is 51. by which roote you muſt diuide the number giuen, Videlicet 1344. and the quotient will be 26. which ſhall be the ſlancke, now if you diuide the foreſaid front 51. by 3. the quotient will ſhew how many ſhall be in a rancke, that is 17. Finally, if you multiply the ſlancke, which is 26. by 3. the product thereof will be 78. which is the iuſt number of the rankes which you muſt haue.

How to ſet a battell ſquare of men called in Italian,
Battaglia quadra d'huomini.

TAke the ſquare roote of the number giuen, and that ſhall be both the front and the ſlanck, which if you multiply together, the product thereof will make vp the number firſt giuen, and if you would know how many men are to be put in a rancke, & how many ſuch rancks you muſt haue, then doe as you did before in diuiding the front by 3. and multiplying the ſlancke by 3.

How to ſet a long ſquare battell which we call the Hearſe battell, and is called in Italian, Battaglia dun tanto emezzo.

TO the number giuen, adde the iuſt halfe thereof, & the ſquare roote of that Summe ſhall be the front, by which roote, or front if you diuide the firſt number giuen, the quotient ſhall be the ſlancke: As for example, let the number giuen be 6144. the halfe thereof is 3072. which being added to the giuen number 6144. maketh in all 9216. the ſquare roote whereof is 96. which ſhal be the front, by which roote or front if you diuide the giuen number 6144. you ſhall find in the quotient 64. and that ſhall be the ſlancke, that done, diuide the foreſaid front 96. by 3. and you ſhall finde in the quotient 32. which number ſheweth how many men ſhall be in a rancke, then multiply the foreſaid ſlancke 64. by 3. and the product thereof ſhall be 192. which is the number of the rankes.

How

How to set a battell of so much and a third, called in Italian, Battaglia dun tanto & dun terzo.

TO the number giuen, adde the third part thereof, & the square roote of that Summe shall be the front: then diuide the first number giuen by the foresaid roote or front, and the number in the quotient shall be the flancke: As for example, let the number giuen be 1575. the third part whereof is 525. which being added to 1575. maketh in all 2100, the roote whereof is 45. which must be the front, by which roote or front, if you diuide the number giuen which was 1575. the quotient will be 35. which shall be your flancke, then by diuiding 45. which is the front by 3. the quotient will shew you how many men you must haue in a rancke, that is 15. Againe by multiplying the flancke which is 35. by 3. the product thereof will be 105, which is the number of your rankes.

How to finde out the Cubique *Roote of any number.*

Cap. 26.

AS the square roote is said to bee a number, which being multiplied in it selfe, doeth make a square superficiall number, hauing onely length and breadth, so the Cubique Roote is a number which being first multiplied in it selfe, and the product thereof being againe multiplied by the first number, doth make a Cubique or Corporall number, hauing both length, breadth, and depth: As for example, 2. times 2. maketh 4. and 2. times 4. maketh 8. Againe 3. times 3. maketh 9. and 3. times 9. maketh 27. and so you may deale with all the rest of the 9. Digits, and make thereby a Table containing both the square numbers and Cubique numbers

of euery roote, consisting of any one of the 9. Digits, like vnto this table here following:

Rootes	Squares	Cubiques
1.	1.	1.
2.	4.	8.
3.	9.	27.
4.	16.	64.
5.	25.	125.
6.	16.	216.
7.	49.	343.
8.	64.	512.
9.	81.	729.

When hauing to finde out the Cubique roote of any number that is greater then 1000. (for lesser it cannot be to worke vpon) then set a pricke vnder the first figure on your right hand, and so proceede towards the left hand, omitting alwaies 2. figures betwixt euery two prickes, as in this example 41063615. and looke how many prickes there bee, so many figures shall you haue in the quotient: That done, you haue to finde out three seuerall numbers, first such a Cubique number as will cleane take away the number which standeth right ouer the head of the last pricke on the left hand, or so much thereof as may bee, which you may easily find in the foresaid table: The roote of which Cubique number, you must set downe in the quotient, the second number which you haue to finde is a number called the Triple, which is easily had by tripling the quotient, & the third number is called the Diuisor, which you shall most readily finde by multiplying the quotient into the Triple, both which numbers are to be placed in such order as followeth. First then hauing found the Cubique number as is before said, and taken the same out of the number standing ouer the last pricke on the left hand, write the remainder, (if there bee any) ouer his head, cancelling that which is vnder it, and then place the roote of the said Cubique number in the quotient: that done, Triple the roote set downe in the quotient, and that shall be the Triple which you must place in the second voide space on the left side of the next pricke which is on your right hand, then multiply that Triple by the quotient, and the product thereof shall bee the Diuisor which must bee placed right vnder the Triple one figure shorter towardes the left hand: that done, draw a line as you see in the example hereafter following and worke thus: First aske how many times the first figure of the saide Diuisor is contained in the number standing right ouer his head: and hauing found an apt

Digit

Digit for the purpose, put that Digit in the quotient to his fellow: that done, multiply the said Digit into the Diuisor, and set the product thereof right vnder the Diuisor. Secondly multiply the said Digit in him selfe, & againe the product thereof into the triple, & set the sume that comes thereof right vnder the triple: Thirdly multiply the said Digit in it selfe cubically, and set the product thereof lowest of all, right vnder the next pricke on the right hand: that done, drawe a line, and by Addition bring all the foresaid three products into one summe, placing euery figure so as you may easile take the said summe out of the vpper number, whereof you seke the Cubique roote, and write the remainder (if there be any) ouer the head, and if such summe will not be subtracted out of the vpper number, then you must seke out a lesser Digit, reseruing still the former triple and Diuisor, and if there bee more pricks in the number then two, then you must for euery pricke finde out a new Triple, and a new Diuisor by tripling the whole quotient, and by working continually in like order as the rule before teacheth, which rule you shall more plainly perceiue by example thus: first then hauing to finde out the Cubique roote of the number before mentioned, which is 41.063.625. marked with prickes as before is taught, resort to the Table wherein you shall finde such a Cubique number as will take away as much of the 41. as may bee, which is 27. the roote whereof is 3. for al the other Cubique numbers in the table are either too small or too great, and therefore you must alwayes haue due consideration thereof. Then take 27. which is the Cubique number, out of 41. and there remaineth 14. which remainder you must set ouer the last pricke on your left hand, cancelling the 41. as in this example.

Then triple the quotient which maketh 9. 14.
which you must set downe vnder the figure 41.063.625.(3
6. next vnto the second pricke which is on your
right hand: Then to finde out the Diuisor, multiply the Triple 9. by 3. which is the quotient, and the product thereof shal be the Diuisor: which diuisor you must place right vnder the triple one figure shorter towards the left hand: that done, drawe a line as you see in this example.

Now

Now hauing orderly set downe the Triple and the Diuisor, aske how many times 2, which is the first figure of the Diuisor is contained in 14. standing right ouer his head, and remember to make choise of such a Digit as may not cleane take away the whole number at the first, but rather leaue so much as the said quotient hauing afterward to be multiplyed diuers waies as shall be said hereafter, may take away the rest or as much therof as may be, as in this example following, you shall finde the aptest Digit for this purpose to be 4, which you must put in the quotient, whereby the quotient shall be now 34. that done, you must first multiply this last quotient which is 4. into the Diuisor 27. the product whereof is 108, which you must set downe right vnder the Diuisor, beneath the line already drawne as you see in this example.

14
44063625 (34.
Triple--||9|
Diuisor--27.
108

Secondly you must multiply the said 4 in it self quadrickly which maketh 16, then multiply that 16. by the triple 9. the product whereof is 144. which is to be set right vnder the triple as in this example.

14
44063625 (34.
Triple--||9|
Diuisor.-27|
108|
144

Thirdly you must multiply the said 4 in it selfe cubically, which maketh 64, which is to be set right vnder the next prick on the right hand beneath the former summes, as you see in this other example.

So as euery one of the foresaide three products doe extend on further then another by one figure towards the right hand, as you see in ỹ former example: Now these products being thus placed, drawe another line & bring all the three seuerall products contained betwixt the 2. lines, into one summe by Addition, & you shall

14
44063625
Triple' 9|
Diuisor 27||
108||
144|
64

finde

finde the totall summe to be 12304, which being subtracted out of the number standing right ouer it which is 14063. there will remaine 1759 which you must set downe aboue as you see in this example.

Now to proceede with the next, you must finde out a new Triple and a new Diuisor.

How is that done?

1
X4759
4X0632625(34
Triple 9
Diuisor 27
108
144
64
12304

Thus, multiply the whole quotient which is 34. by 3. the product whereof is 102. and that is the Triple, which is to be placed in the next voide space hard by the next pricke that is on your right hand: Then multiply the whole quotient into the last found Triple 102. and the product thereof which is 3468. shall be your Diuisor, which is to be placed vnder the Triple one figure shorter towards the left hand as you see in the example following: which two numbers being thus found and rightly placed, drawe a line, then aske how many times the first figure of your Diuisor which is 3. is contained in the number right ouer his head which is 17. and you shall finde it to be 5. times contained therein, wherefore set downe 5. in the quotient, that done, multiply the 5. into the Diuisor, and place the product therreof which is 17340. right vnder the Diuisor beneath the line, as you see in this example.

Secondly square the same 5. that is to say, multiply it in it selfe, and that maketh 25. which 25. you must multiply againe into the Triple 102. the product whereof is 2550. which number you must set right vnder the said triple beneath the line. Thirdly multiply the said 5. in it selfe Cubically, which maketh 125. and place that right vnder the first pricke on the right hand, and drawe a line: that done, adde all the foresaid 3. products together, and you shall finde the totall summe thereof to be 175962 5. which being subtracted out of the vp-

1
X4759
4X0632625(349
Triple 102
Diuisor 3468
17340

per

per number, there remaineth nothing, as this example plainely sheweth.

Whereby you may conclude that the foresaid number wherof you sought the roote, is a perfect Cubique number, for if you multiply the whole quotient in it selfe cubically, it wil produce the selfe same number whereof you sought the roote. But note, that if in making the first Subtraction, the first Diuisor is not to be found in the vpper number, then you must set a Cypher in the quotient, that done, triple the whole quotient, and place the said Triple vnder the figure which is next to the next pricke on the right hand, working in such order as before, and to auoide confusion, hauing to deale with a multitude of numbers it shall not be amisse at the finding out of euery new Triple, and Diuisor to set the remainders in seuerall places by themselues, and to worke them in the selfe same order that is before taught, also note that if you haue to deale with a few numbers, and that the diuisor cannot be subtracted out of the number standing right ouer his head, then you must set a Cypher in the quotient and so you haue done. As for example, hauing to take the cubicall roote of 8597. here I find 2. to be the quotient, which being cubically multiplied, doth cleane take away the 8. and now according to my former rule 12. must be my Deuisor, which because I cannot take it out of 5. I set downe therefore a Cypher in the quotient, so as the quotient is now 20. which is the cubicall roote of the foresaide number, for if you multiply 20. cubically and adde thereunto 567. which is the remainder, the summe thereof will be like vnto the first number, as you may see in this example.

X

X4759

4X863625 (345

Triple 102

Diuisor 3468

17340

2550

125.

1759625

8 567. 12

20

20

6 Triple (20 400

Diuisor 2

8000

567

8567

Of Astronomicall Fractions.

Cap. 27.

BEcause the vse of these Fractions is very necessarie for those that haue to calculate the motions of the Starres and the difference of time, I thought good to shew here how the same are to be added, subtracted, multiplyed and diuided, for the measure of time falleth not out alwayes to bee a whole yeare, moneth, day, or hower, nor the moning of the celestiall bodies are to be measured alwaies by whole circles, signes, or whole degrees & therfore to haue an exact measure of such thyngs it was thought best by the auncient writers to diuide all whole thinges called Integra into the lesser parts that might bee, for which purpose no number was thought so meete as 60. for there is no number vnder 100. that receiueth so many Diuisions as 60. which may bee diuided many sundrie waies, that is by 2.3.4.5.6.10.12.15 20. and by 30, and therefore they diuide euery whole thing that had no vsuall partes into 60 minutes, and euery minute into 60 seconds, and euery second into 60 thirds, and so forth into 60 fourths, fifts, sixts, seuenths, eights, ninthes and tenths, and further if need were, but that seldome chanceth. And you haue to note that minutes are marked with one streeke ouer the head, seconds with two streekes, thirdes with three streekes, and so forth thus $'.''.'''.$ &c. which doe signifie 23. minutes 6. secondes 7 thirdes, and 8. fourthes.

Of Addition.

WHat is to be obserued in adding of these kindes of Fractions?

First that you bring Integrums to Integrums, and Fractions

ons to Fractions, that bee of like denomination, beginning alwaies with the leaſt on the right hand, and if the Summe of ſuch Addition doe amount any where to the number of 60. or aboue 60. then you muſt looke how many 60. are comprehended therein, and for euery 60. adde one to the next greater Fraction that is on the left hand, obſeruing ſtill that order vntill you come to the Integrums, of which Integrums it is alſo neceſſarie to know their value, that is to ſay, what parts they containe, and what denomination thoſe parts haue: As for example, if you adde common ſignes ſuch as the twelue ſignes of the Zodiaque bee, then euerie ſigne containeth 30. degrees, ſo as euery ſumme exceeding 30. is to be diuided by 30. but if they be Phiſicall ſignes whereof 6. doe make a whole circle, ſuch as be ſet downe in the table of Alphonſus, then the ſumme of thoſe degrées is to be diuided by 6. Moreouer ſo often as the ſumme of the common ſignes doe exceede 12. or the ſumme of the Phiſicall ſignes doe exceede 6. the ouerplus is alwaies to be reiected, and the remainder to bee ſet in the place of the ſignes, as you may ſée in this example following, wherein ſeconds are reduced to minutes, minutes to degrées, and finally degrées to ſignes.

An example of Addition conſiſting of ſignes, degrees minutes and ſeconds.

The totall ſumme.

Signes	Degrees	Minutes	Seconds.
9.	19.	1.	19.
0.	0.	35.	16.
11.	29.	33.	5.
9.	29.	38.	11.
0.	11.	49.	40.
		4.	56.
8.	0.	42.	27.

In which example beginning firſt with the ſeconds, becauſe they are here the leaſt Fractions, you ſhall finde by Addition that the ſumme of them amounteth to 147. which being diuided by 60. you ſhall finde in the quotient 2. and the remainder to be $\frac{''}{1}$. which remainder you muſt ſet downe vnder the colum of ſeconds, keeping the quotient which is 2. in mind to be added to the colum of minutes, the ſumme whereof is 162. which being diuided by 60. you ſhall finde in

in the quotient 2. degrées, and the remainder to be 4′2. which is to be set downe vnder the collum of minutes, and the quotient 2. kept in minde to be added to the collum of degrées, the Summe whereof is 90. degrées, which being diuided by 30. (because that 30. degrées doe make one common whole signe) you shall find in the quotient 3. signes and no remainder: wherefore you must set downe a Cypher vnder the collum of degrées, and adde the 3. signes to the collum of signes, the summe whereof is 32. which if you diuide by twise 12. which maketh 24. you shall finde the remainder to be 8. signes, which is to be set downe vnder the collum of signes, for the quotient here is to be reiected according to the rule before giuen, so as the totall summe of this Addition is 8. signes, 0. degrées 4′2. 2″.

Another example of daies, howres, minutes, and seconds to be added together.

Daies	Howres	Minutes	Seconds.
21.	14.	232.	11.
16.	16.	19.	41.
8.	16.	30.	30.
46.	23.	22.	22.

Summa totalis.

In this example one self order as in the other before is to be obserued as touching the seconds and minutes, for the exceeding number in both, are diuided by 60. but when you come to the howres you must diuide that number by 24. because that so many howers doe make a whole day, and hauing set downe the remainder vnder the collum of howers, adde that one day which was in the quotient, vnto the collum of daies, and so you shall find the totall summe to be as the example aboue sheweth.

Of Subtraction.

WHat order is to be obserued in Subtraction.

The selfe same that was before obserued in Addition, so as you alwaies remember, that when you haue to take a greater number of Fractions, as of minutes, seconds, thirds and such like, out of the lesser number of Fractions, to borrowe 60. and hauing set downe the remainder to adde the one borrowed, vnto the

next

next collum on the left hand, for there the 60. borrowed, is but one, but if you haue to deale with degrées, which are counted Integrums, then you muſt borrow but 30. for ſo many degrées doe make one ſigne, and if you haue to ſubtract howers, then you muſt borrow 24. for ſo many houres doe make one day, as by the example here following you ſhall more plainely perceiue.

In this example becauſe you can not take $''_{13}$. out of $''_{7}$. you muſt borrowe one minute from the next collum on the left hand, which one minute is $''_{60}$. which being added to 27. doe make in all $''_{87}$. out of which if you take $''_{13}$. there will remaine $''_{74}$. that done you muſt pay home the minute which you borrowed by adding the ſame vnto the next 9. on the left hand, which maketh 10. then ſay, take 1′0. out of 4′2. and there remaineth 3′2 which being ſet downe, proceede to the next. But here to take one out of none that cannot be, and therefore borrow one whole ſigne from the collum of ſignes, which is 30. degrées, from whence take one, and there remaineth 29. which being ſet down, take the one which you borrowed out of 8, and there remaineth 7. ſo as the whole remainder of this Subtraction is 7 / ſignes, 29 / degrées, 3′2 / and $''_{74}$. as the former example ſheweth.

Signes	Degrees	Minutes	Secondes
8.	0.	42.	27.
0	1.	9.	53.
7.	29.	32.	34.

Of Multiplication.

THough there be more difficultie in multiplying and diuiding Aſtronomical Fractions then in adding or ſubtracting them, yet the greateſt difficultie thereof chiefly conſiſteth in the finding out of the true denommation of the products, for firſt as touching Multiplication, you muſt multiply euery number of the multiplyer into all the particular numbers of the ſumme that is to be multiplyed, and then ſeuerally to adde together the products that be of one ſelfe denomination, and whatſoeuer in that Addition ariſeth to the number of 60. or exceedeth 60. it is to be reduced by the ſexagenarie Diuiſion into the greater ſumme, ſo ſhall you collect the

whole

whole ſumme of the multiplication. But you haue to note by the way, that if there be any Integrums of diuers denominations in your multiplyer: That then ſuch Integrums muſt be reduced to one ſelfe kinde of Integrums: As for example, ſuppoſe that you would multiply the daily motion of the Moone, which according to Alphonſus tables, is 13. degrées, 1′0. ″, ‴. and ⁗. by 29. daies, 12. houres, 44. and ″, here becauſe there be in this multiplyer Integrums of diuers denominations, that is to ſay, daies and howers, you muſt therefore reduce the ſame into one ſelfe denomination, before that you can make your multiplication.

How is that to be done?

By multiplying euery number of the ſaid multiplyer by 5. and then by halfing the product thereof, by which halfing you ſhall reduce minutes to ſeconds, and ſeconds to thirds, and ſo forth to the ſmalleſt Fractions of all, and if any product doe amount to 60. or exceede 60. then you muſt diuide that product by 60. the remainder whereof is to be ſet vnder his proper denomination, and you muſt keepe the quotient in mind to adde the ſame to the next greater number as this example or table ſheweth: In the front whereof I haue ſet downe in ſeuerall ſpaces not onely the denominations of the two Integrums, as daies & howers, but alſo the denominations of ſo many Fractions as I thinke meete to ſerue my turne, vnder which front I place the foreſaid multiplyer, and then draw a line as you ſee in this example following.

Denomination.
The multiplyer to be reduced into one ſelfe denomination.
The products of the reduction.

Daies	Howers	′	″	‴	⁗
29.	12.	44	3		
	29.	21	50	7	30

Now beginning firſt on the right hand with the leaſt Fraction of the ſaid multiplyer which is ″, I multiply 3. by 5. which maketh 15. the one halfe whereof is ‴. and halfe a third which is ⁗. wherefore I ſet downe the ſaid ‴. and ⁗. vnder their proper denominations as you ſee in the example aboue, then I multiply 44 by 5. the product whereof is 220. and the halfe thereof is 110. which being diuided by 60. the quotient is ′. and the remainder ″. which remainder I ſet vnder his proper denomination, keeping

ping the quotient still in mind, that done, I multiply 12. howres by 5. the product whereof is 60. and the halfe of that is 30. whereunto by adding the one which I had in minde, I make it 31. and so I set it downe vnder his proper denomination, and because there be no more fractions to be multiplyed, I set downe on the left hand the Integrum 29. and by this meanes I haue brought the foresaid multiplyer to one selfe denomination and to one kinde of integrum, that is to say, to 29. daies, $31^{'}1.{}^{''}_{50}.{}^{'''}_{7}.{}^{''''}_{30}$. which now being the greater number is to be set aboue, and to be multiplyed by the foresaid dayly motion of the Moone, that is 13. degrees $1^{\circ}{}^{''}_{35}.{}^{'''}_{1}$. but to the intent that in multiplying these numbers together you may set euery product in his true place, that is to say, vnder his proper denomination, it shall not be amisse in the front of your worke to set downe two rowes of numbers, whereof the first must containe so many denominations or Fractions as you thinke good, as minutes, seconds, thirds, fourthes, and so forth, marked with streekes and vulgar numbers, and the second rowe shall be the naturall order of numbers written in Arithmeticall figures as this table sheweth.

Integra	′	″	‴	⁗	v	vi	vii	viii	The denominations.
	0.	1.	2.	3.	4.	5.	6.	7.	The naturall numbers.

Vnder which table you must first set the number that is to be multiplyed, and right vnder that the Multiplyer in such sort as euery particular product may be placed vnder his proper denomination, and then draw a line as you see in this example following, and when you haue multiplyed 2. numbers the one into the other, and know not where to place the product, then marke vnder which of the naturall numbers in the front, the said two numbers that is to say, the multiplier and the multiplicand doe stand: That done, adde those two naturall numbers of the front together, and the summe thereof will shew you vnder what denomination the product is to be placed, as in this example.

In

Integra.	i	ii	iii	iiii	v	vi	vii	Denominations Naturall numbers.
0	1	-	3	4	5	6	7	
29	31	50	7	30				The Multiplicand.
13	10	35	1					The Multiplier.
			29	31	50	7	350	
		1015	1085	1750	245	1050		The ſeuera' products
	290	315	500	70	300			
377	403	650	9	390				The generall product or totall ſumme.
389	6	24	3	31	12	37	30	

In which example I firſt multiply $''_{1}$. into $'''_{10}$. the product whereof is $^{vii}_{30}$. which muſt be ſet vnder the denomination vii. becauſe the two naturall numbers that is 3. ſtanding ouer 1. the multiplier and 4. ſtanding ouer 30. the Multiplicand being added together doe make 7. appointing to the product his proper denomination, then multiply againe the ſame $''_{1}$. into $''_{7}$. the product whereof is $^{vi}_{7}$ which muſt bee ſet vnder the denomination vi. becauſe 3 ſtandeth ouer both their heades, and therefore muſt be taken twice, that is to ſay, for each number 3. which being added together doe make 6. appointing thereby to the product his proper place of denomination, that done multiply the ſaid $''_{1}$ into $''_{50}$. the product whereof is $''_{50}$. which muſt be ſet vnder the denomination v. for the 3. which ſtandeth ouer 1. and the 2. ouer $''_{50}$. being added together maketh 5. appointing to the product his proper place of denomination, then multiply the ſaid $''_{1}$ into $3'1$. the product whereof is $'''_{31}$. here the two naturall numbers, that is to ſay 3. ſtanding ouer $''_{1}$. & one ouer $3'1$. being added together, do make 4. appointing to the product his proper place of denomination, then multiply the foreſaid $'''_{1}$. into 29. Integrums. the product whereof is $'''_{29}$. & muſt be ſet vnder the denomination, $'''$ becauſe 3. ſtandeth ouer $'''_{1}$ but 29. being an Integrum, hath no naturall number ſtanding ouer him but a Cypher, thus hauing gone throughout all the numbers of the Multiplicand, with the firſt number of the Multiplyer, proceede in like order with the ſecond number of the Multiplyer which is $''_{1}$. which being multiplyed into $''''_{30}$ maketh $^{vi}_{1050}$ to be ſet vnder the denomination vi. becauſe 2. ſtandeth ouer $''_{1}$. the multiplier, and 4. ouer $''_{30}$. the Multiplicand, which 4. and 2.

being added together maketh 6. then multiply $'_{15}$. by $'''_{7}$. which maketh $''_{45}$. which you must set down vnder the denomination $''$. because 2. and 3. maketh 5. that done, multiply $''_{35}$. by $''_{10}$. which maketh $'''_{1750}$. which you must set downe vnder the denomination $''''$ because the multiplicande and the multiplier are both vnder the denomination $''$ which being twice repeated, maketh 4. then multiply $''_{35}$. by $3'_{17}$, and that maketh $'''_{1015}$. which you must set downe vnder the denomination $'''$ because 1. and 2. maketh 3. finally multiply 29. Integrums, by $'_{15}$. and that maketh $''_{015}$. thus as you haue gone through with two numbers of your multiplyer, so proceede in like order with the other two numbers of the multipiper which is 10. and 13. and when you haue ended your Multiplication, and set euery product in his proper place, and so as euery figure may stand one right vnder another, to auoide confusion when you come to Addition, (to which end the spaces of collums had neede to be the larger) then draw a line vnder all the products, and beginning on the right hand, adde all the products contained in euery seuerall collum together, and if the summe of any such particular Addition do arise to the summe of 60. or exceed the number of 60. then diuide that summe by 60. and set downe the remainder, keping the quotient in mind, to be added to the product of the next collum on the left hand, so shal you find the total summe of your Multiplication to bee 389. degrées $6'_{24}{}''_{2}{}'''_{3}{}''''_{12}{}^{v}_{3}{}^{vi}_{7}$. and $^{vii}_{30}$. as the former example plainly sheweth. Now if you diuide 389. degrées by 30. because euery common signe containeth 30. degrées, you shall finde your totall summe to be 12. signes, 29. degrées, $6'_{24}{}''_{2}{}'''_{31}{}''''_{12}{}^{v}_{57}{}^{vi}$. and $^{vii}_{30}$. and so much the Moone runneth in the space of 29 dayes 12. howres, 44. and $\frac{1}{2}$. of an howre, which is her full reuolution betwixt euery two changes, but for as much as it chanceth as well in this example as in many others like, that Integrums of two sundry denominations are propounded in the question, it may very well be doubted with what denomination the product of such multiplication is to be named, as in this example hauing multiplyed time by motion, a man may aske whether the product shall bee named dayes, or degrees, the resoluing of which doubt dependeth vpon the nature of the question propounded, for in the foresaid example, because time of dayes doe comprehend any certaine appointed motion, therefore the product of the multiplication

cation is to be referred to the degrees of motion which are comprehended vnder time, and not to time which comprehendeth motion, wherefore this product of Integrums videlz. 389. signifieth here degrees and not daies, so likewise when degrees and minutes are multiplied by myles and minutes, the product of such Multiplycation taketh his name from myles and not from degrees, because degrees doe comprehend miles, for we say in matters of Geography, that euery degree of the great Circle comprehendeth 60. myles, thus hauing spoken sufficiently of the Multiplycation of Astronomicall Fractions, we will now proceede to the Diuision of such Fractions,

Of the Diuision of Fractions Astronomicall.

WHat is to be obserued therein?

First you must consider whether your Diuisor be compound, or simple, I call that compound which containeth Fractions of diuers denominations, and that simple which consisteth of Integrums, or is one whole number of one selfe denomination, wherein there is no difficultie, for then you haue no more to doe but to diuide euery particular number cõtained in the diuidend by that same Diuisor, and to place the product of euery one vnder such denomination, as the little table of denommations sheweth, & therefore it shall not be amisse to set the foresaid little table ouer your diuidend euen as you did in Multiplycation: Also the Seragenary progression is alwaies to be vsed, as well in Diuision as in Multiplycation. Moreouer if your Diuisor be not exactly contained in ỹ diuidend, then hauing Multiplyed the diuidend by 60. you must adde to the product thereof the next Fraction following: As for example, knowing by Alphonsus tables, that the daily motion of the Moone is 13. degrees, 10. ′. 35. ″. 1. ‴. 14. ⁗ you would know how much she goeth in the space of an howre, here because that one day containeth 24. howers, the number must be 24 your Diuisor which is simple and not compound, first then set downe in the front of your worke the rowe of denominations onely, and not the naturall numbers because they are not to be vsed in this way of Diuision, that done, right vnder the rowe of denominations place your diuidend, and right vnder that your Diuisor, as you see in this example.

degrees.	′	″	‴	⁗	⁵	The Denominations.
14	10	35	1	15		The dividend.
24						The Diuisor.
	32	56	27	33	7	The seuerall summe of euery quotient.

In which example because the Diuisor 24. is not contained in 13. therfore I multiply 13 by 60. which maketh 780. whereunto by adding the next Fraction on the right hand which is 1′0. the whole Summe is 79′0. which being diuided by 24. the quotient is 3′2 which because they are minutes, I place them vnder the denomination of minutes, and the remainder is 2′2. which being multiplyed by 60. maketh $_{1}{}^{''}{}_{320}$. whereunto I adde the next figure which is 35. and so the whole summe is $_{1}{}^{''}{}_{355}$. which being diuided by 24. the quotient is $_{56}{}^{''}$. which I place vnder the denomination of seconds, and the remainder of this Diuision is $_{11}{}^{''}$. which being multiplyed by 60. maketh $_{660}{}^{'''}$. whereto I adde the next Fraction which is $_{15}{}^{'''}$. so that now the whole summe is $_{661}{}^{'''}$. which being diuided by 24. the quotient is $_{27}{}^{'''}$. which I set downe vnder the denomination of thirds, and the remainder is $_{13}{}^{'''}$. which being multiplyed by 60. maketh $_{780}{}^{''''}$. whereunto I adde the next Fraction which is $_{33}{}^{''''}$. which maketh in all $_{813}{}^{''''}$. which being diuided by 24. the quotient is $_{33}{}^{''''}$. which I place vnder the denominatiō of fourths and the remainder is $_{21}{}^{''''}$. which being multiplyed by 60. maketh $_{1260}{}^{⁵}$. whereunto hauing no Fraction to adde, I diuide the same by 24. and so I find in the quotient $_{52}{}^{⁵}$. which I set vnder the denomination of fifts, so as I find the howerly motion of the Mone to be 3′2. $_{56}{}^{''}{}_{27}{}^{'''}{}_{33}{}^{''''}{}_{52}{}^{⁵}$. and somewhat more, for I leaue to deale any further with the smaller fractions that would still grow by multiplying the remainders by 60. thinking this sufficient to shew you in what order you haue to worke, to diuide your diuidend by a simple Diuisor, into as many small parts as you will: but if your Diuisor be compound, then the diuision is to be done either by reductiō into the smallest Fractions, or without reductiō: which last way is very hard and tedious, and therefore I will onely shew you how to make your diuision whereof the Diuisor is compound by reduction, and that by this one example here following. Suppose then that the Mone according to her owne course which is from West to East, is distant from some fixed Starre 36. degrees, 3′0. $_{14}{}^{''}{}_{10}{}^{'''}$. and $_{15}{}^{''''}$. and that you would know in what time she will runne

that

that diſtaunce according to her daily mouing which as hath beene ſaid before is 13. degrees, 1'0. $^{''}_{15}$. $^{'''}_{,}$. and $^{''''}_{15}$. here to make this diuiſion by reduction, you muſt doe thus. Firſt reduce all the numbers of your deuidend into the ſmalleſt Fractions therof by the Sexagenarie Multiplication and Addition of the next Fraction vnto the product of that Multiplication, that done, reduce all the numbers of your Diuiſor by like Multiplication and Addition, into the ſmalleſt Fractions, ſo as the diuidend & the Diuiſor may be both of one ſelfe denomination, and diuide the one by the other, euen as they were Integrums, as in this example you muſt firſt multiply 36. degrees by 60. and it will make 2160. whereto by adding 30 you make the whole ſumme of minutes to bee 2190. which being multiplyed againe by 60. doe make $^{''}_{131400}$. whereto if you adde the $^{''}_{14}$. the ſumme of ſecondes will bee $^{''}_{131414}$. and ſo proceeding ſtill with the Sexagenarie Multiplication and Addition of the next Fraction as you did before, you ſhall find the diuidend to be $^{''''}_{47312947}$. Then in like order reduce your Diuiſor into the ſmaleſt Fraction, and you ſhall finde the totall ſumme therof to be $^{'''}_{1707600}$. this reduction being made, diuide the diuidend by the diuiſor, ſo ſhall you finde in the quotient two Integrums, that is to ſay 2 dayes, and the remainder to be $^{''''}_{133907161}$. which remainder if you multiply by 60. and diuide the product by the ſelfe ſame Diuiſor, ye ſhal haue in the quotient minutes, then multeply againe that remainder by 60. and diuide the product thereof by the ſame Diuiſor, and you ſhall haue in the quotient ſeconds, and ſo by obſeruing ſtill that order you ſhall bring it into as ſmall Fractions as you will, thus ſhall you finde that the Moone according to her daily motion, will runne the foreſaide ſpace of diſtance that was betwixt her and the fixed Starre in two daies, 4'6. and 1''4.

Howe to diuide Astronomicall *Fractions when the Diuisor is* greater then the diuidend,

Cap. 28.

THough by the last chapter you may learne how to diuide any number in Astronomicall Fractions whereof the Diuisor is greater then the diuidend, yet I minde once againe, to set downe a generall rule to serue for such purpose, because it commeth often in vse in hauing to deale with Astronomicall tables, and to giue you example thereof: First then hauing to diuide any number, whole Diuisor is greater then the diuidend, doe thus: multiply the greatest denomination of the diuidend by 60. and if there be any Fractions annexed thereunto which are of the next inferiour kinde, as minutes are to degrées, or to howers, and seconds to minutes, and thirds to seconds &c. Then adde them to the former product, but if such Fractions be not of the next inferior kind, then let them stand as they are vntill you come to deale with them, and hauing deuided according to the common rule of Diuision the first summe of the diuidend by the Diuisor, multiply the quotient into the whole Diuisor, and subtract that product out of the vpper number if it may bee, if not, then take the quotient lesser and lesser, vntill you can finde such a number as will be subtracted out of the said vpper number, and if there be any remainder left, then multiply that remainder by 60. not leauing to follow ỳ former order of working, vntill you haue found the nearest exact quotient that may be. And you haue to note that the denominatiõ of the first quotient must be of ỳ next inferior kind, to that denomination which the Diuisor hath, and to make this rule the plainer I wil set downe an example vsed by Stadius in the 115 Page of his Ephemerides, who to know the very instant of the ful Moone the second of March 1569. biddeth to diuide the distance of the oppositiõ which was 8 degrées, 4'6. by the diurnal excesse of the Moones

motion,

motion from the Sunne which was then 13. degrées 4'8. which Diuiſor becauſe it is greater then the dividend, you muſt accor-ding to the rule before giuen, worke thus: Firſt multiply the greateſt denomination of the diuidend which is 8. degrées by 6'0. the product whereof will be 4'80. wherunto by adding the Frac-tion annexed videliz. 4'6. it maketh in all 52'6. which is to be di-uided by 13. degrées. 4'8. here in diuiding the laſt product firſt by 13. degrées, I finde in the quotient 39. which is one too many, con-ſidering that I muſt take out of the foreſaide dividend 4'8 as often as I did take out thereof 13. degrées, wherefore I ſet downe but 38. in the quotient, and then the remainder will be 96. which be-cauſe I may eaſily diuide by the common Diuiſor 13. degrées, and 4'8. I diuide therefore that 96. firſt by 13. whereof the quo-tient is 7. and the remainder is 5. which I reduce into ſeconds by multiplying that 5. by 60. the product whereof is 300. that done, I multiply 4'8. by 7. the product whereof is 336. which though it bee ſomewhat too great a number to bee taken out of 300. yet I let it ſtand becauſe it approacheth to a very nigh exactneſſe, and by this meanes I finde the whole quotient to bee 3'8. and $\frac{7}{13}$. and you haue to note that if after the firſt quotient be ſet downe, there hap-pen any remainder which is leſſer then the Diuiſor, then you muſt ſet downe a Cypher in the quotient, and remoue your Diuiſor one place further, euen as you doe in common Diuiſion, and then to worke as before.

How to take the ſquare Roote of *Aſtronomicall Fractions.*

Cap. 29.

THe greateſt difficulty hereof conſiſteth in finding out the true denomination of the roote, for if the Fraction be ſeconds, then the roote ther of are mi-nutes, and if the Fraction bee fourths, then the roote are ſeconds, for the Fraction muſt alwaies haue ſuch denomination as may bee halfed, ſe-conds, fourthes, and ſuch like, the one halfe whereof giueth alwaies name

name to the rote, for if the question be of thirds, you must first reduce them to fourths before you can take the roote, and you must doe the like with any other Fraction, whose denomination is odde and not euen. As for example, if you would take the Rote of $''_{43}$. here by multiplying these $''_{43}$. by 60. you shall reduce them into $2580''$. the roote whereof is $''_{50}$. Moreouer the Fractions wherewith you haue to deale, are either simple, or compound, if they be simple and lesse then minutes, and therewith haue euen denominations and not odde, then you nede to make no further reduction, but to worke as if you had to deale with whole numbers. As in seeking the square roote of $''_{1600}$. you finde it to be iust 40. but if the number be compounded, that is to say, cõsisting of Integrums and Fractions, or of many Fractions hauing diuers denominations, then you must first reduce them all to the smallest Fraction that hath an euen denomination before that you can take the roote: As for example, you would know the roote of 4. degrees, 2'5. here you must by the Seragenarie, Multiplication and Addition of the next Fraction, reduce the degrees to minutes, and the minutes to seconds, as you were taught before in Diuision, and then to worke as you were wont to doe in taking the square roote of whole numbers, and in so doing, you shall finde the summe of seconds to be $''_{14400}$. the square roote whereof is 12'6. which if you diuide by 60. it will make 2. degrees, 6'. Another example, as to take the roote of 13. degrees, 4'2. and $''_{50}$. here by reduction as before, you shall bring the degrees and minutes to 49. 36"5. the square roote whereof is 22'2. which being diuided by 60. maketh 1. degrees, 4'2. And thus I end with the Astronomicall Fractions, which kinde of Fractions, though they bee very learnedly and orderly taught by Reinoldus in the beginning of his Ptutenicall tables, yet in mine opinion not in so plaine order, and so fit for euery mans vnderstanding, as I haue here set them downe according to the doctrine of Gemma Frisius, which being once learned, you shall the soner attaine to the other. And without the knowledge of these Fractions, you can neuer truely calculate any thing out of the Astronomicall tables, and therefore such Fractions are most necessarie to be learned.

Notwithstanding the better to Calculate by the said Ptuteni-

call

call Tables or by any other Astronomicall Tables, I must set downe here one thing more, which I had cleane forgotten in my first Edition, that is to declare vnto you, that in those Tables are often vsed two kinds of denominations, whereof the one is called Sexagenæ and the other Sexagesimæ and that the denomination Sexagenæ being set ouer any number doth signifie that the vnite of the Integrum is multiplyed by 60. But the denomination Sexagesimæ doth signifie that the vnite of the Integrum is diuided by 60. and you haue to note that Sexagenæ haue the like partes or denominations that Sexagesimæ haue as Primes ′. ″. ‴. and so forth differing onely in placing the said denominations, for the denominations of the Sexagenæ are alwaies set on the left hand of their Integrums, but the denominations of the Sexagesimæ are set on the right hand of their Integrums. And to ease you of your paine as well in multiplying & in diuiding as also in taking the square Roote of Astronomicall Fractions, I haue thought good to set downe this Table heere following called the Sexagenarie Table together with the description and vse thereof which Table is also set downe in my first Edition.

The

The description and vse of the *Sexagenarie Table.*

THis table consistethof two figures, whereof the neather figure hauing fower Angles, is called in Latine Trapezium, marked with the letters A. D. E. B. and the vpper figure is a Triangle, marked with the letters A. B. C. and each figure containeth particular colums of numbers, seruing to finde out the products of Astronomicall Fractions being multiplyed one by another, and also the quotients of the like Fractions being diuided one by another, and also the square rootes of the said Fractions, for which purpose the first collum on the left hand, containeth 59. Fractions, counting from 1. standing aboue, and so proceeding down-ward to 59. and are contained betwixt A. and D. and the foote of the said Trapezium, containeth 30. counting from the left hand towardes the right, which are contained betwixt D. and E. and the rest of the numbers to make vp 59. are to be found in the vppermost front of the Triangle, proceeding from C. towards A. you haue to note also that in the outermost collum of the Trapezium on the right hand, the numbers doe proceede downeward from 30. to 59. that is from B. to E. and the numbers in the outermost colum of the Triangle on the right hand, doe proceede vpward from 31. to 59. contained betwixt B. and C. both which doe serue to fill vp the first multiplyers, and multiplycands, for when you cannot finde them in the Trapezium, then the outermost collum of the Triangle on the right hand, seruing to supply that want, and when you cannot finde the said numbers in the Triangle, then the outermost collum of the Trapezium on the right hand, serueth to supply that want, and in seeking any multiplyer or multiplicand, either

eyther in the Trapezium, or in the Triangle, consider alwayes which way they are most readily found out, so as they may directly answere one against another.

All the rest of the numbers contained betwixt the two outermost collums and are set downe in square Angles, called common Angles do signifie eyther Products or dividends or square numbers according as occasion shall require. And the outermost collums do signifie sometime multiplyers, sometime multiplicands sometime quotients, and sometime rootes. All which things you shall better understande by the examples hereafter following.

The vse of the Table.

By helpe of this table you may more readily multiply & divide Astronomicall Fractions, and also find out the square rote of such Fractions, then by those rules which I haue heretofore set downe according to the doctrine of Gemma Frisius. And first I will set downe an example of Multiplication, then an other of Division, and thirdly one example of finding out the square rote of the said Fractions, and let the example of multiplication be thus: Suppose that you would multiply 29. degrees, $3'1,_{I}{}''.{}_{II}{}'''.{}_{III}{}''''.{}_{IV}{}'''''.$ by 13. degrees, $1'0,_{I}{}''.{}_{II}{}'''.{}_{III}{}''''.$ which you must set downe in such order as followeth, (that is to say) first the denominations, then next vnder them the multiplicand, and next vnder that the multiplier, and vnder them the seuerall products, and lowest of all the total sume of the saide products.

	Integra	De.	I	II	III	IV	V	VI	VII	
		29	31	50	7	30				Denominations
		13	10	35	1					The Multiplicand.
										The Multiplier.
					29	31	50	7	30	The first product.
			17	13	34	14	22	30		The second product.
		4	55	18	21	15	0			The third product.
	6.	23	53	51	37	30				The fourth product.
	6.	29	6	24	2	31	12	37	30	The totall summe.

Here beginning with the first number of the multiplyer on the right hand which is $_{III}{}''$ say thus, one times 30. is 30 which is to bee placed vnder the denomination of 7. because the denomination ouer 1. is 3. and the denomination ouer 30. is 4, which being added together according to the rule before sette downe

downe in the Chapter of Multiplycation of Astronomicall Fractions do make 7. then say one times 7. is 7. which you must place vnder the first denomination. Againe, one times 50. is 50. which is to bee set vnder the fift denomination, because 3. and 2. maketh 5. then say one times 31. is 31. which is to bee set vnder the fourth denomination, for 3. and 1. maketh 4. then one times 29. is 29. which is to be set vnder the third denomination, and thus you haue the first product, then proceede with the nert number of the multiplyer towards your left hand which is 35. and is to be multiplyed into 30. which to doe readily, you must enter the table with these two numbers, and seeking in the first Collum of the Trapezium on the left hand, for 35. in the foote of the saide Trapezium, for the number of 30. you shall finde in the common angle the product to bee 17. and 30. whereof you must place the 30. vnder the first denomination, and keeping the number 17. still in minde to be added to the nert product, multiply 35. into 7. and you shall finde in the Trapezium, the product to bee 4. and 5. whereunto if you adde the 17. which you had in minde, the product will be 4. and 22. whereof you must set the 22. vnder the fift denomination, and keeping the 4. in minde, multiply againe the same 35. into 50. the product whereof you shall finde in the Triangle to be 29. and 10. whereto if you adde the 4. in minde, it will make 29. and 14. whereof the 14. is to be placed vnder the fourth denomination, and keeping the 29. in minde, multiply againe the saide 35. into 31. and you shall finde the product thereof in the Triangle to bee 18. and 5. whereunto if you adde 29. in minde, it will make in all 18. and 34. which 34. is to be set vnder the third denomination, then keeping 18. in minde, multiply the foresaide 35. into 29. and you shall finde the product thereof in the Trapezium to be 16. and 55. whereunto if you adde the 18. in mind, the product will be 17. and 13. which 13. is to be placed vnder the second denomination, now because you haue gone through all the numbers of the multiplicande with the number 35. you must place the 17. which you had in minde vnder the denomination of minutes, and so hauing ended the second product, proceede to the finding out of the third product by multiplying 10. first into 30. the product whereof you shall finde in the Trapezium to bee 5. and 0. whereof you must set the Cypher vnder the fift denomi-

nation

nation, and keeping the 5. in mind multiply againe 10. into 7. and you shall find the product to be 1. and 10. whereunto if you adde the 5. in mind, the product will be 1. and 15. whereof you must set the 15. vnder the fourth denomination, and keeping the one in minde, multiply 10. into 50. and you shall find the product thereof in the Trapezium to be 8. and 20. whereunto if you adde the 1. in mind, it will make 8 and 21. whereof you must set the 21. vnder the third denomination, and keeping 8. in mind, multiply 10. into 31. and you shall find the product thereof in the Trapezium to be 5. and 10. vnto which if you adde the 8. in minde, the product will be 5. and 18. whereof set downe the 18. vnder the second denomination, and keeping 5. in minde multiply 10. into 29. the product whereof you shall finde in the Trapezium to be 4. and 50. whereunto if you adde the 5. in mind, the product will be 4. and 55. Now because you haue gone through all the numbers of the Multiplicand, with 10. you must set downe the 4. which you had in minde vnder the denomination of degrees, and so hauing the third product, proceede to the fourth by multiplying 13. into 30. & you shall find the the product in the Trapezium to be 6. and 30. whereof set downe 30. vnder the fourth denomination of Fractions, and keeping 6. in mind multiply 13. into 7. the product whereof you shall finde in the Trapezium to be 1. and 31. whereunto if you adde the 6. in minde, the product will be 1. and 37. whereof set downe the 37. vnder the third denomination, and keeping the 1. in mind multiply 13. into 50. and you shall find the product in the Trapezium to be 10. and 50. whereunto if you adde the one in mind, the product will be 10. and 51. whereof set the 51. vnder the second denomination of Fractions, and keeping 10. in minde multiply 13. into 31. the product whereof you shall finde in the Trapezium to be 6. and 43. whereunto if you adde the 10. in mind, the product will be 6 and 53. whereof set downe 53. vnder the first denomination of Fractions, and keeping 6 in mind multiply 13. into 29. the product whereof you shall finde in the Trapezium to be 6. & 17. whereunto if you adde ỳ 6. in mind, the product will be 6. and 23. whereof set downe 23. vnder the denomination of degrees. Now because you haue gone through all the numbers of the multiplicand with the last number of the multiplyer, you must set downe the 6. which you had in minde vnder

the

the denomination of Integrums, that done, adde all the foure products together, beginning on the right hand, saying thus, 30. and 0. is but 30. which set downe vnder the nethermost line, as you see in the former figure, then say 30. and 7. maketh 37. which you must set downe vnder the nethermost line next vnto 30. then say 22. and 50. maketh 72, out of which by subtracting the Sexagenarie number, the remainder is $\frac{v}{12}$. which is to be set vnder the line next vnto the 37. keeping still the 60. in minde, which in this account maketh but one, and is to be added to the next ranke on the left hand, then say 1. in mind and 5. maketh 6. and 4. maketh 10. and 1. maketh 11. here set downe 1. and keepe the Article in minde, then say 1. in minde and 3. maketh 4. then 1. and 1. and 3. being added to 4. doe make in all 9. out of which 9. you must subtract 6. which is but one 60. and is to be kept in mind, and there remaineth 3. which is to be set downe by the 1. then say 1. in minde and 7. is 8. and 1. is 9. and 4. is 13. and 9. is 22. here set downe 2. and keepe the 2. Articles in mind, then say 2. and 3. maketh 5. and 2. is 7. and 3. is 10. and 2. maketh 12. tennes, which doe make 2. sixties, and are to be kept in mind, then say 2. and 1. maketh 3. and 8. maketh 11. and 3. maketh 14. wherefore set downe 4. keeping the 1. Article in mind, then say 1. in mind and 5. is 6. and 1. is 7. and 1. is 8. then take 6. from 8. and there remaineth 2. which set downe by the 4. and keepe one sixtie in mind, then say 1. in mind and 3. is 4. and 5. is 9. and 7. is 16. wherefore set downe 6. and keeping one in mind, say that 1. and 5. is 6. and 5. is 11. and 1. is 12. which maketh two sixties to be kept in minde, then say 2. in minde and 3. is 5. and 4. maketh 9. which set downe, then say 2. is 2. which set downe by the 9. vnder the denomination of degrees, then say 6. and nothing maketh 6. which set downe vnder the denominations of Integrums, for that 6. in this place signifieth 6. sixties, which is in value 360. degrees, and being diuided by 30. because 30. degrees maketh one whole signe, you shall finde in the quotient 12. signes, so as the totall summe of the foure productes is 12. signes, 29. degrees, $6'\ {}^{ii}\ {}^{iii}\ {}^{iiii}\ {}^{v}\ {}^{vi}\ {}^{vii}_{34^{\circ}\ 2^{\circ}\ 31^{\circ}\ 13^{\circ}\ 37^{\circ}\ 30^{\circ}}$ as the former figure sheweth, and this is the very same example which I wrought before when I taught you how to multiply Astronomicall Fractions according to Gemma Frisius his rule, and they both doe wholly agree in euery condition, sauing that to

worke

worke by the Sexagenarie Table is the readier way of the two.

An example how to diuide Astronomicall Fractions by helps of the Sexagenarie Table.

SVppose then that you would diuide the former totall summe or product found by Multiplication, which is 6. Integrums, 29. degrees, $6^{\circ}\ 29^{\circ}\ 6'\ 24''\ 2'''\ 31''''\ 12^{v}\ 37^{vi}\ 30^{vii}$. by this Diuisor 29. degrees, $3^{\circ}\ 1^{\circ}\ 0'\ 0''\ 7'''\ 30''''$. which in the former example of Multiplication was the multiplicand. Now to diuide these two numbers the one by the other, you must doe thus, first you must set downe the rowe of denominations as you did before in Multiplycation, and next vnder that the diuidend, then right vnder that the Diuisor, and on the right hand behind a crooked line made like a halfe Mone, all the seuerall quotients are to be set one by another in a right line, as you may see by the figures hereafter following.

Heere hauing made your rowe of denominations, and set downe your diuidend, you haue to consider whether the first number of your Diuisor be greater then the first number of your diuidend, for if it be, then you must place your Diuisor one space further towardes your right hand, as in this example, because the first number of your Diuisor 29. cannot be taken out of 6. you set it vnder the second number of the diuidend, and so all the rest of the numbers successiuely towardes the right hand, as the former example sheweth. Now the order of working is thus: You must first seeke out the first number of your Diuisor in the first collum of the Trapezium on the left hand, which is 29. then in the rowe right against that 29. on the right hand, you haue to seek out those numbers of the diuidend, which do stand right ouer the first number of your Diuisor which is 6. and 29. and if you cannot finde those numbers iustly, then seeke in the selfe same rowe a number which is somewhat lesse and nearest in value vnto it, as in this example, because you cannot finde 6. and 29. you take 6. and 17. the quotient whereof you shall find in the foote of the Trapezium right vnder the said number 6. and 17. to be

Denomination	integrum	dc.	I	II	III	IIII	V	VI	VII
The diuidend.	6	29	6	24	2	31	12	37	30
The Diuisor.		29	31	50	7	30			

13. degrees, which you must set in the quotient line, and that is your first quotient, hauing his proper denomination ouer his head, which are degrees, and are to be found by the rule before taught. Thus you see here that the number of the Diuisor is to be found in the outermost collum on the left hand, and the number of the dividend in that rowe which is right against the said Diuisor, and the quotient in the foote of the Trapezium right vnder the number of the dividend last found. Then you haue to multiply the whole Diuisor (that is to say) euery particular number thereof by the first quotient 13. which you may doe by helpe of the Table, as you did before in the example of Multiplycation, and is to be set downe in this manner. And you 29.31.50.7.30 shall finde the whole product to be 6.23.53.51. 13. 37.30.

Which being set right vnder the first dividend, is to be subtracted out of the same, and the remainder to be written ouer the head of the dividend as you doe in common Diuision, first then to multiply all the particular numbers of the Diuisor by the quotient 13. and to find euery product thereof, resort to the Table and take for 13 in the foote of the Trapezium, and for 30. which is the multiplicand in the outermost collum of the Trapezium on the left hand, and the common Angle will shew the product which is 6. and 30. whereof you must set downe 30. vnder 30. and keeping 6. in mind, multiply againe 13. into 7. the product whereof you shall finde to be 1. and 31. vnto which adde the 6. which you kept in mind, and the product shall be 1. and 37. whereof you must set downe 37. and keeping one in mind, multiply againe 13. into 50. and you shall find the product to be 10. and 50. whereunto if you adde 1. in minde, the product shall be 10. and 51. whereof you must set downe 51. and keeping 10. in mind, multiply 13. into 31. the product whereof you shall find in the Trapezium to be 8. and 43. whereunto if you adde the 10. which you had in mind, the product shall be 6. and 53. whereof set downe 53. and keeping 6. in mind, multiply 13. into 29. and you shall find the product to be 6. and 17. whereunto if you adde the 6. in mind, the product shall be 6. & 23. whereof set downe 23.

	29	31	50	7	30	The Diuisor.
					13	The first quotient.
6	23	53	51	37	30	The first product.

vnder

vnder the laſt number of your multiplicand, and becauſe you haue no more numbers of the Diuiſor to be multiplyed, ſet downe 6. in minde on the left hand, ſo ſhall the whole product bee 6.23.53.51. 37.30. as the former example ſheweth, which product is to be ſubtracted out of the firſt dividend, & the remainder is to be ſet downe ouer the heade of that dividend, as you ſee in this example next following, wherein the firſt dividend is firſt ſet downe, and right vnder that the foreſaid product, which is the firſt product, and the remainder aboue the dividend, and the quotient 13. is ſet in the quotient line which is your firſt quotient:

The remainder		5	12	32	25	1				
The firſt dividend.	6	29	6	24	2	31	12	37	30	(13.
The firſt product	6	22	53	51	37	30				

And remember (in making your Subtraction) to begin with the firſt number of the foreſaide product which is on the right hand, and when you cannot take it out of the number ſtanding right ouer his head, to borrow alwaies 60. of the next number on the left hand, and to pay it home againe with 1. for there 60. is but one. This done, remoue your Diuiſor one ſpace further towards the right hand (that is to ſay) ſet the firſt number of your Diuiſor vnder 12. which is the ſecond number of the ſecond dividend, which together with the firſt remainder is 5.12.32.25.1.12.37.30. and all other numbers of the Diuiſor orderly towards your right hand, as you ſee in this example.

Then aſke how many times 29. is in 5.& 12. which number you must ſeeke in the Trapezium in the rowe that anſwereth towards the right hand, to the firſt number of your Diuiſor which is 29. ſtanding in the outer moſt collum of the Trapezium on the left hand, and becauſe you cannot find 5. and 12. in that rowe, you muſt take in the ſame rowe the number which is nigheſt vnto it, but leſſe, which you ſhal finde to be 4. and 50. and right vnder that in the foote of the Trapezium you ſhall finde 10. which muſt be your ſecond quotient, by which quotient you haue to multiply all the particular numbers of the Diuiſor in ſuch order as is before ſet

The ſecond dividend.	5	12	32	25	1	12	37	3
The diuiſor		29	31	50	7	50		

dow e and you shall finde the product of that multiplicaton to be 4.55.18.21.15.0. which product you must place vnder the second dividend setting 4. vnder 5. and 55. vnder 12. and so forth orderly towardes the right hand, that done, subtract the same product out of the numbers of the second dividend, standing right ouer the said product, and the remainder will be 17.14.3.46.12. as you see in this example.

The remainder	17	14	3	46	12	37	30		
The second dividend.	5	12	32	55	1	12	27	30	(13.10.
The second product.	4	55	18	21	15	0			

Now remoue your Diuisor one space further towardes the right hand by setting the first number of your Diuisor which is 29 vnder 14. which is the second number of the third dividend, and so all the rest orderly towardes the right hand, as you see in this example.

Then aske how many times 29. is contained in 17. and 14. which dividend because you cannot finde it in the rowe that answereth to that 29. which standeth in the outermost Collum of the Trapeziũ on the left hand (for al those numbers are too little) you must seeke for it in that collum which standeth right vpon 29. in the foote of the Trapezium, neither shall you finde it there, but you shall find 16. and 55. which is somewhat lesser yet in value nigheſt vnto 17 and 14. and right a gainſt that you shal finde in the outermost collum on the right hand 35. which must be your third quotient to be set in the quotient line, whereby you haue againe to multiply the whole Diuisor in such order as before, the product whereof you shall finde to be 17.13.34.14.22.30. which product being placed vnder the dividend by setting 17. vnder 17. and 13. vnder 14. and so forth orderly towards the right hand, subtract the said product (beginning at the right hand) out of the numbers which stand right ouer the said product, and the remainder will be 29.31.50.7.30. which is to be set downe ouer the third dividend, and the rest to be cancelled as you see in this example.

The third dividend.	17	14	3	46	12	37	30
The Diuisor.		29	31	50	7	30	

The

The remainder			29	31	50	7	30	
The third diuidend.	xx	x4	3	46	xx	37	38	(13.10.35.
The 3. product	xx	x3	x4	x4	xx	30		

And now the remainder of the third diuidend is come to be the fourth diuidend, wherefore remoue your Diuiſor one ſpace further towards the right hand by ſetting 29. vnder 29. and the reſt orderly towards the right hand as you ſee in the example following. Then aſke how many times 29. is contained in 29. which being but once, your fourth quotient is 1. and is to be ſet in the quotient line, whereby the whole Diuiſor being multiplied, the product will be 29.31.50.7.30. which you muſt place vnder the fourth diuidend, and being ſubtracted out of the ſame, nothing will remaine, & ſo the whole quotient will be 13. degrees, 1'0.3" 5.1''' as you ſee in this example.

The fourth diuidend.	0	0	0	0	0		
The fourth product.	29	xx	50	7	30		degr. ' " "'
	29	31	50	7	30		(13.10.35. 1.

Another example of Diuiſion.

IF the daily motion of the Moone be 13. degrees $3'_{13}\ ''_{10}\ '''_{6}\ ''''_{2}\ v_{8}$ in what time ſhal ſhe make her whole reuolution allowing 360. degrees to that reuolution, which is otherwiſe called the moneth of Paragration. Heere for ſo much as this example is to be wrought by Diuiſion, and that your diuidend is a ſimple & whole number (that is to ſay) 360. degrees, without any Fractions of diuers denominations annexed thereunto: you muſt firſt ſet downe the 360. degrees, and next to that towardes your right hand ſet downe a long row of Cyphers with ſo many denominations ouer their heads as you ſhal thinke needfull to ſerue your turne, & right vnder your diuidend ſet your Diuiſor as you ſee in this example.

The denominations	Integrum	De.	'	''	'''	''''	v	vi	vii	viii	ix
The diuidend		360	0	0	0	0	0	0	0	0	0
The Diuiſor.		13	3	53	56	23	58				
The 1 product		352	45	16	22	47	6				

(27.

Here you must first aske how many times 13. is in 360. and by the common rule of Diuision you shall find the quotient to be 27. which you must set downe in the quotient line, and by that quotient you haue to multiply euery particular number of the Diuisor beginning on the right hand, as you doe in Multiplycation, saying that 27. times 53. is 26. and 6. as the Trapezium sheweth, for by seeking 27. in the foote of the Trapezium and for 58. in the outermost collum on the right hand, you shall find in ỹ common Angle 26 and 6. wherefore set downe 6. vnder 58. and keeping 26. in mind, multiply 23. which is the second number of the Diuisor by 27. and by the Trapezium you shall find the product thereof to be 10. and 21. whereunto if you adde the 26. in mind, it will make 10. and 47. whereof set downe 47. vnder 23. and keeping 10. in mind, multiply 56. which is the third number of the Diuisor by 27. and in the Trapezium you shall finde the product to be 25. and 12. whereto if you adde the 10 in minde, it will make 25. and 22 whereof set downe 22. vnder 56. and keeping 25. in mind, multiply 53. which is the fourth number of the Diuisor by 27. the product whereof you shall find by the Trapezium to be 23. and 51. whereto if you adde 25. in mind, it will make 76. which is one 60. and 16. whereof set downe 16. vnder 53. & adde the one in mind to 23. & that will make 24. which you must keepe in mind, then multiply 3. which is the fift number of the Diuisor by 27. the product whereof you shall find in the Trapezium to be 1. and 21. whereto if you adde the 24. in mind, it will make 1. and 45. whereof set downe 45. vnder 3. and keeping 1. in mind, multiply 13. which is the last number of the Diuisor by 27. the product whereof you shall find in the Trapezium to be 5. and 51. whereunto if you adde one in mind, it will make 5. and 52. here because the first 5. is 5. sixties, it maketh in all 352. and is to be set vnder 360. so as the first product of this Multiplycation containeth these numbers 352.45.16.22.47.6. as you see them set downe in the former example, and this product is to be subtracted out of 360. which is the first diuidend. And to auoide confusion, it shall not be amisse to set downe the first Diuidend and the first product apart by themselues thus.

The first remainder.	7	14	43	37	12	54	0	0	0	(27
The first diuidend	360	0	0	0	0	0	0	0	0	
The first product	353	45	17	22	47	6				

Heere beginning on the right hand say thus, take 6. out of nothing which will not bee, wherefore you must borrow 60. then by taking 6. out of 60. there will remaine 54. which you must set aboue that Cypher which standeth right ouer 6. and cancell the 6. keeping still the one 60. which you borrowed in mind, then say 47. & one in mind maketh 48. which will not be taken out of nothing, and therefore you must borrow againe one 60. as you did before, so shall the remainder bee 12. which is to bee set aboue the Cypher which standeth right ouer 47. and cancell 47. and so proceede with like order in subtracting all the rest of the numbers of the first product out of the first diuidend, so shall the remainder be 7. 14. 43. 37. 12. 54. as you see them set downe in the former figure. Now hauing to remoue your Diuisor one space further towardes the right hand, you shall doe well to make your first remainder which is 7. 14. 43. 37. 12. 54. to be your second diuidend, and vnder that to set your Diuisor as you see in this example.

The second diuidend	7	14	43	37	12	54	0	0	0	(27. 33.
The diuisor.		13	3	53	56	23	58			

Then aske how many times 13. is contained in 7. and 14. and hauing found 13. in the foote of ỹ Trapezium, seeke in that collum for 7. and 14. and not finding it there, take in the selfe same collum that number which is nighest in valu vnto it & lesse, which you shal finde to be 7. and 9. right against which in the outermost collum on the right hand is 33. which must be your second quotient, and is to be set in the quotient line, next vnto 27. and by this quotient you haue to multiply euery number of the Diuisor as you did before, the product wherof you shal find to be 7. 11. 8. 40. 1. 10. 54. wherfore you must first set downe your second diuidend, and then the second product right vnder the same as you see in this example.

The second remainder.		3	34	57	11	43	6			
The second diuidend.	7	14	43	37	12	54	0	0	0	(27. 33.
The second product.	7	11	8	40	1	10	54			

Which product being subtracted out of the second dividend, the remainder will be 3.34.57.11.43.6. which is to be set aboue the second dividend, and the product to be cancelled as you see in the former example. Here hauing to remoue againe your cõmon Diuisor one space further towards the right hand, set downe first the last remainder which now must bee your third dividend, and vnder that set the common Diuisor as you see in this example.

The third diuidend.	3	34	57	11	43	6	0	0	0	(27. 33.16.
The diuisor.		13	3	53	56	23	58			

Then aske how many times 13. is contained in 3. and 34. here by seeking in the foote of the Trapezium for 13. though you cannot finde in that collum 3. & 34. yet you shall find 3. and 28. which is the nigheſt, right against which in the outermoſt collum on the left hand, you shall finde 16. which must be your third quotient, and is to bee set in the quotient line, by which quotient you must multiply the whole Diuisor as before, the product whereof you shall finde to be 3.29.2.23.2.23.28. which being the third product you must set downe vnder the third dividend which was your last remainder, and to bee subtracted out of the same as you see in this example.

The third dividend.		5	54	48	40	42	32	0	0
The third product	3	34	57	11	43	6	ø	ø	ø
	3	20	2	23	2	23	28		

And so the remainder will be 5.54.48.40.42.32. which you must set aboue the third dividend, and all the inferior numbers are to be cancelled as you see in the former example. Here hauing againe to remoue your Diuisor one space further towards your right hand, the last remainder must be your fourth dividend, vnder which the common Diuisor is to be set thus.

									dales	'	"	"'
The 4. dividend	7	54	48	40	42	32	0	0	(27	33	16	26
The diuisor.		13	3	53	56	23	58					

Here asking how many times 13. is contained in 5. and 54. seeke for 13. in the foote of the Trapezium, in whose collum you shall not finde 5. and 54. but 5. and 51. which is nigheſt vnto it

it, and right a gainſt that in the outermoſt collum on the left hand you ſhall finde the quotient to be 27. by which if you ſhould multiply the whole Diuiſor, the whole product thereof would be 5.56.21.24.1.47.6. which is more then the diuidend, and therefore you muſt make your quotient one leſſe, ſetting downe no more but 26. in the quotient line, by which if you multiply the Diuiſor, the product will bee 5.26.41.22.25.14.8. which being ſubtracted out of the fourth diuidend, the remainder will bee 28.7.18.17.17.52. which remainder if you will, you may make to be a fift diuidend, and then to worke as before, if you would haue your quotient to extend to ſmaller denominations, which I leaue to do becauſe I thinke that thirds be ſmall inough. And as often as the product of any particular quotient ſhal bee greater then the diuidend, remember to take a leſſe quotient euen as you doe in common Diuiſion. But now you haue to note that though this whole quotient here ſignifieth time, for the firſt quotient ſignifieth dayes, the ſecond quotient minutes of daies, the third quotient ſeconds, and the fourth quotient thirds, yet for ſo much as the day is to be counted by 24. houres and not by minutes, you muſt therefore reduce all the particular quotients ſauing the firſt, into. howers and parts of howers, euen to ſo ſmall denominations as you ſhall thinke good your ſelfe, by helpe of this rule, which in Diuiſion of Aſtronomicall Fractions biddeth to multiply the quotient by 2. and to diuide the product thereof by 5. as here if you multiply the 33. which is the ſecond quotient by 2. the product will bee 66. which being diuided by 5. the quotient will be 13. houres and one firtie remaining to be kept in minde, wherefore ſet downe in the place of 3'3.13. houres, then multiply the third quotient which is 16. by 2. and that will make 32. wherunto if you adde the one 60. in minde it will make in all 92. which being diuided by 5. the quotient will bee 18. and two firties, which is 120. remaining to be kept in minde, wherefore in ſteede of 16''. which was the third quotient, ſet 18'. of an houre, and then proceede to the fourth quotient which is 4'''. which being multiplyed by 2. maketh 52 wherunto if you adde 120. it will make 172. which if you diuide by 5. the quotient will bee 34''. of an hower, which is to bee ſet downe in the place of 26. ſo ſhall your whole former quotient contai ne

taine 27. dayes, 13. howers, 1'1. of an houre and 3"4. of an houre And note that as in the Diuision of Astronomicall Fractions to bring the quotients to like denominat ion, you doe multiply by 2. and diuide by 5. so in Multiplication to reduce the numbers of the multiplyer being of diuers denominations to one selfe denomination, you must by order reuerse, multiply by 5. and diuide by 2. whereof I haue giuen you an example before, whereas I shew you how to multiply Astronomicall Fractions according to Gemma Frisius, without the helpe of the Sexagenarie table.

An example shewing how to extract the square roote out of Astronomicall Fractions, by helpe of the Sexagenarie Table.

SUppose the number giuen to be $17.\,{}^{\prime}_{12}\,{}^{\prime\prime}_{33}\,{}^{\prime\prime\prime}_{4}$. whereof you haue to take the square roote, here hauing set downe the saide numbers with the proper denominations ouer their heads, as you see in the example following, first set a pricke vnder the last number on the right hand, & then pricke euery other number leauing one voide space betwixt euery two prickes, as you doe when you seeke the square roote of whole numbers or Integrums, as you see here in this example.

	′	″	‴	⁗
Then resort to the table The number giuen	17.	12.	33.	4.

& seeke amongst the productes

which are placed next to the line A.B. as well in the Trapezium, as in the Triangle, and see whether you can finde the number standing ouer the first pricke on the left hand which is 17. and 12. but not finding it there, you must take that which is nighest vnto it & lesse, which you shall finde in the Triangle towards B to be 17.4, the roote whereof you shall finde both in the head, and also in the outward collum of the Triangle on the right hand to be 32. answering to the foresaide square roote, which roote you must place behinde the quotient line, then subtract 17. and 4. out of 17. and 12. and there will remaine 8. which is to bee set ouer 12. and the 17. and 12. to be cancelled, that done, double the roote 32. which will be 64. that is to say 1. and 4. and setting 1. vnder 8. and 4. vnder 33. aske how many times 1. is in 8. and there is 8. which

is

is the second quotient by which you must multiply 1. and 4. the product whereof will be 8. and 32. which being subtracted from the vpper number which is 8. and 33. the remainder is 1. which is to be set ouer 33. and the 8. and 33. to be cancelled. Finally multiply the second quotient 8. in it selfe, and the product will be 1. and 4. which being subtracted out of the former remainder of the giuen number nothing remaineth, so as you shall find 3′2.8″. to be the roote of the giuen number, as this example sheweth.

| | | |

is 3. and 2. and the remainder will be 13. which is to be ſet ouer 2. and the 3. and 2. to be cancelled as you ſée in the former example, that done, double the foreſaid found roote 13. which will make 26. by which you haue to diuide 13. and 9 wherefore reſort to the Trapezium, in the roote whereof you ſhall find 26. in whoſe collum not finding 13. and 9. take that which is nigheſt vnto it and leſſe, which is 13. and 0. right againſt which you ſhall find in the outermoſt collum on the right hand 30. which ſhould be your quotient, but becauſe it is too great, and that the ſquare thereof cannot be taken out of the remainder, you muſt make the quotient one leſſe, and ſet in the quotient line no more but 29. by which 29. if you multiply 26. the product will be 12. and 34. as the Trapezium ſheweth, which being ſubtracted out of 13. & 9. ſtanding ouer 26. the remainder will be 35. which 35. is to be ſet ouer 9. then by multiplying the ſecond quotient which is 29. into it ſelfe, you ſhall find by the Trapezium the product to be 14. and 1. which being ſubtracted out of 35. and 17. the remainder will be 21. and 16. which is to be ſet ouer 35. and 17. as you ſée in this example.

That done, double both the quotients or whole roote, and the product will be 26. 58. and hauing ſet 58. vnder 8. and 26 vnder 16. diuide 21. 16. and 8. by 26. 58. wherefore looke for 26. in the roote of the Trapezium, and for 21. 16. in that collum, and not finding it there, take that which is nigheſt vnto it and leſſe, which you ſhall find to be 21. and 14. & right againſt that in the outermoſt collum on the right hand ſtandeth 49. which being too great to be your quotient by 2. therefore make your quotient no more but 47. which being ſet downe in the quotient line, multiply thereby 26. 58. and the product will be 21. 7. 26. which being ſubtracted out of 21. 16. and 8. the remainder will be 8. and 42. then ſetting 42. ouer 8. and 8. ouer 16. cancell 21. 16. and 8. then multiply 47. into it ſelfe ſquarely, and you ſhall find the product thereof in the Triangle to be 36. 49. which being ſubtracted out of 8, 42. and 0. the remainder will be 8. 6. 11. as you ſée in this example.

21

X3 3 5 16

3. 2. 9 X. 7. 8. 0. (13. 29.

2 49 26 The double of the firſt quo.

14. 1 The ſquare of the ſecond quotient.

And

And thus you haue found the roote of your giuen number to be 13.29.and 47. and whether you haue done right-ly or not, you may know by multiply-

XX 8 6
XX.35.X6.42.11 ′ ″ ‴
3.2.9.X7.8.6. (13.29.47.
2.49.26.X.58.49
XX.34.26.26.
X4.7.36
2X

ing the ſaid roote into it ſelfe ſquarely, and by adding to the pro-duct thereof the remainder, and if you would finde a more exact roote, then adde more Cyphers to your giuen number towardes your right hand, together with their denominations ouer their heads as they encreaſe ſucceſſiuely, and be ſure alwaies that the number of the Cyphers bee euen and not odde as 2.4.6. and ſo forth, and the more Cyphers that you adde to the giuen number (ſo as the number of them be euen) the more exact roote you ſhall haue.

Now to giue to euery number of the roote his proper denomi-nation, doe thus, take halfe of thoſe denominations that are ouer euery pricke, and thoſe ſhall be the denominations of the roote, as in the former example, whereas ſecondes doe ſtand ouer the laſt pricke on the left hand take halfe of that wich is 1'. wherefore the firſt number of your roote muſt be minutes, and ouer the reſt of the numbers of the roote ſet ſeconds, thirds, and ſo forth ſucceſſiuely vntill you haue brought your roote to as ſmall denomination as you deſire.

FINIS

A BRIEFE Deſcription of the ta-

bles of the three ſpeciall right lines be-longing to a Circle, called Signes, Lines Tangent, and Lines Secant.

Not only ſhewing why they were firſt inuented, and defining the proper tearmes thereto belonging.

But alſo ſhewing diuers neceſſarie vſes thereof, written by Maiſter *Blundeuile*, 1593.

LONDON.
Printed by Iohn VVindet, 1606.



The Deſcription and vſe of the *Tables of Sines.*

BEcauſe there is no proportion, comparison, or likenes betwixt a right line, and a crooked, the auncient Philoſophers, as Ptolomey and diuers other, were much troubled in ſeeking to know the meaſures of a Circle or of any portion thereof by his Diameter, and by knowing the Diameter to finde out the length of any Chorde in a circle, which is alwaies leſſer then the Diameter it ſelfe, and finding that the more parts whereinto the Diameter was diuided, the nearer they approached to the truth: Some of them therefore, as Ptolomey, diuided the Diameter of a circle into 120. parts, and the Semidiameter into 60. parts, and euery ſuch part into 60. and euery minute into 60. ſeconds &c. And in like manner did Arzahel, an auncient Arabian, who diuided the Diameter into 300. partes and the Semidiameter into 150. and euery of thoſe parts into 60. and ſo forth as before, according to which computation they made their Tables: but becauſe the working by thoſe Tables was very tedious and troubleſome, by reaſon that it was needfull continually to vſe the art of numbring by Aſtronomicall Fractions: therefore Georgius Purbachius, and Regio Montanus his Scholler to auoide that trouble of calculating by Aſtronomicall Fractions, diuided the Diameter of a Circle into a far greater number of parts, and made ſuch tables as are vſed at this preſent, the deſcription and vſe whereof both hereafter follow, firſt of thoſe that are ſet downe by Monte Regio in Folio, and then of thoſe that were lately Corrected and made perfect by Clauius the Ieſuite which are printed in quarto.

And because that the way to find out the proportion which any chord hath to the whole Diameter, was very hard, therefore the said Purbachius and Monte Regio hauing direction from certaine propositions of Euclid, as from the 47. proposition of his first booke, and from the third proposition of his third booke, and also from the 15. proposition of his fift booke, they made choise of the halfe chord and Semidiameter of the Circle, calling the halfe chord, Sinum rectum, and the Semidiameter Sinum totum. And because that the proportion of any circumference to his diameter neuer changeth, how great or how little so euer the Circle be: after that they had calculated for one Circle, they made such tables as might serue for all Circles, and though these Tables of sines doe suffice to worke thereby al manner of conclusions, as well of Astronomie, as of Geometrie, yet for more ease, our moderne Geometricians haue of late inuented two other right lines belonging to a Circle, called lines Tangent, and lines Secant, and haue made like tables for them that were made for sines, and both tables, that is to say, as well of the sines, as of the lines Tangent and Secant, haue one selfe manner of working thereby, as shall plainely appeare hereafter when we come to describe the same. But first we will beginne with the tables of sines, and plainely define euery terme or vocable of Art, belonging thereunto: The termes are these here following: An arch, a Chord, Sinus rectus, Sinus versus, Quadrans, Complementum, and sinus Complementi.

The definitions of the foresaid termes.

AN Arch is any part or portion of the circumference of a circle, which in this practise doth not commonly extend beyond 180 degrees which is one half of the circumference of any Circle, how great or small so euer it be, for euery Circle containeth 360. degrees.

A Chorde is a right line drawne from one end of the Arch to the other end thereof, and note that all chordes are alwaies lesser then the Diameter it selfe, for that is the greatest Chorde in any Circle.

Sinus rectus is the one halfe of a Chord or string of any Arke which

which is double to the arke that is giuen or ſuppoſed, and falleth with right angles vpon that Semidiameter which diuideth the double arke into two equall parts.

Sinus vērſus, that is to ſay, turned the contrary way, is a right line, and that part of the ſemidiameter, which is intercepted betwixt the beginning of the giuen Arke and the right Sine of the ſame arke, and this is alſo called in Latine Sagitta, in Engliſh a Shaft or Arrowe, for the Demonſtratiue figure thereof hereafter following, is not vnlike to the ſtring of a bow ready bent, hauing a ſhaft in the midſt thereof.

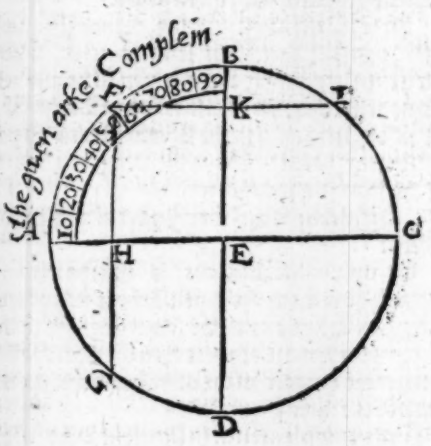
Quadrans is the fourth part of a Circle containing 90. degrees.

Complementum arcus, is that portion of the Circle, which ſheweth how much the giuen Arke is leſſer then the Quadrant: if the giuen Arke do containe fewer degrees then the Quadrant but if it containe more degrees then the Quadrant, then the difference betwixt the quarter of the Circle and the ſaid arch, is the complement of the ſaide giuen Arke.

Sinus complementi, is the right Sine of that Arch which is the complement of the giuen Arke.

Sinus totus, is the Semidiameter of the Circle, and is the greateſt Sine that may be in the Quadrant of a Circle, which according to the firſt tables of Monte Regio containeth 6|000|000. & according to the laſt tables 10|000|000| partes, for the more parts that the totall Sine hath, the more true and exact ſhal your worke bee, notwithſtanding ſometime it ſhall ſuffice to attribute vnto the totall Sine but 60|000. parts, which numbers Appian obſerueth in teaching the way to finde out the diſtance of two places differing both in Longitude and Latitude by the Tables of Sines, and ſome doe make the totall Sine, to contain 100|000. partes, as Wittikindus in his treatiſe of Dials, and diuers other doe the like. Alſo Clauius himſelfe ſaith that in the tables ſet downe by him in quarto, you may ſometime make the totall Sine to bee but 100|000. ſo as you cut off the two laſt figures on the right hand in euery Sine, but you ſhall better vnderſtand euery thing here aboue mentioned, by the figure Demonſtratiue heere following.

The figure Demonstratiue.



In this figure you see first a whole Circle drawne vpon the Center E. and marked with the letters A.B.C.D. which Circle by two crosse Diameters marked with the letters A.C. and B.D. & passing both through the Center E. is diuided into fower Quadrantes or quarters, the vpper Quadrante whereof on the left hand is marked with the letters A.B.E. in which Quadrant, the right perpendicular line marked with the letters F.H. betokeneth the right Sine of the giuen Arke A.F. which right Sine is the one halfe of the chord or string F.G. and the giuen Arke A.F. is the one halfe of the double Arke or bowe G.A.F. and A.H. is the Shaft called in Latine Sinus versus: Againe the letters F.B. doe shew the complement, which together with the giuen Arke A.F. doe make the whole Quadrant A.F.B. which is diuided into 9. spaces, euery space containing 10. degrees, whereby you may plainely perceiue, that in this demonstration, the giuen Arke A.F. is 50. degrees, and the complement F.B. is 40. degrees, both which being added together doe make vp the whole Quadrant of 90. degrees, marked with the letters A.F.B. Now Sinus complementi is the crosse line marked with the letters F.K. the totall Sine, which is the whole Semidiameter, and greatest right Sine, is marked with the letters B.E. But because it is not enough, to know the signification of the things aboue specified to vse the foresaide Tables when neede is, vnlesse you know also

alſo how to find out thoſe things in the ſaid tables, I thinke it good therefore to ſhew you the order of the ſaid tables by deſcribing the ſame as followeth.

You haue then to vnderſtand that the tables of Monte Regio Printed in Folio, are contained in 18. Pages, and euery Page containeth eleauen partitions, called collums, whereof the firſt on the left hand containeth 60. minutes, which are to be counted from head to foote, as they ſtand in order one right vnder another in ſeuerall places, proceeding from 1. to 60. The ſecond collum containeth Sines. The third containeth onely a portion or part of one ſecond, and from thenceforth proceeding towardes the right hand all the other collums doe containe in like manner Sines and the portion of one ſecond. And right ouer the head of euery Sine (the firſt collum of Sines onely excepted, hauing nothing but a Cypher ouer his head) are ſet downe the degrees of the whole Quadrant called Arches, in ſuch order as from the firſt Page to the laſt, there are in all 89. degrees or Arches, as by peruſing the ſaid tables you may plainely ſee. Now to find out in theſe tables the things aboue mentioned, you muſt doe as followeth.

Firſt to finde out the right Sine of any giuen Arke, you muſt ſeeke out the number of the ſaid Arke in the front of the tables, and if the giuen arke hath no minutes ioyned thereunto, then the firſt number of Sines right vnder the ſaid Arke, is the right Sine thereof. But if it hath any minutes ioyned thereunto, then you muſt ſeeke out in that Page, where you found the giuen Arke, the number of the minutes in the firſt collum of the ſaid Page, on the left hand, and right againſt thoſe minutes on the right hand, in the ſquare Angle right vnder the ſaid arch, you ſhall find the right Sine. As for example, you would find out the right Sine of a giuen arke containing 8. degrees, and 20. here hauing found out in the front of the ſecond Page the figure of 8. ſtanding right ouer the eight collum, ſeek in the firſt collum on the left hand of the ſaid Page, for 20. minutes, and right againſt the 20. minutes you ſhal find on the right hand in the common Angle or ſquare 869593. which is the right Sine of the foreſaid giuen Arke, ſo as you make 6/000/00. to be the totall Sine: but if you make 60/000. the totall Sine, then you muſt alwaies reiect the two laſt figures ſtanding on the right hand of ỳ ſaid right Sine, & the reſt of the figures ſhall be the right Sine.

Now to find out the complement, there is nothing to be done, but onely to subtract the giuen arke out of the whole Quadrant, which is 90. degrees, and the remainder shall be the complement: as in the former example by subtracting 8. degrees, 2'0. out of 90. degrees, you shall find that there remaineth 81. degrees, 4'0. which is the complement of that arch. Againe to find out the Sine of the complement you must doe thus, seeke the complement in the front of the tables of Sines, euen as you do to find out any giuen arke: as in the former example, the complement being 81. degrees, 4'0. you must seeke 81. in the front of the 17. Page of the first tables, which being found, seeke out also the 4'0. in the first collum of the said Page on the left hand, and right against those 4'0. in the common Angle right vnder the Arke 81. you shall finde 5/936/649. which number is the right Sine of the foresaid complement, so as you make 6/000/000. to be the totall Sine, for if 60/000. be the totall Sine, then you must reiect (as I said before) the two last figures on the right hand, and the number remaining shall be the right Sine of the foresaid complement, and therefore in working by these tables, you must alwaies remember what number you make the totall Sine to be.

Sinus versus commeth seldome in vse, notwithstanding if you would know how to find it out, you need to do no more but to subtract Sinum complementi of the giuen Arke, out of the totall Sine, and the remainder shall be Sinus versus, as in the former example your Sinus complementi was 5/936/649. which being subtracted out of the totall Sine 6/000/000. there remaineth 63/351. and that number is Sinus versus: for if you adde this remainder to the number which you subtracted, it will make vp the totall Sine 6/000/000. But there is one thing more necessarie to be knowne then this, because it commeth oftner in vse, and that is vpon some diuision made how to find out the Arke of any quotient, which is to be done thus: Enter with the quotient into the body of the tables, and leaue not seeking amongst the squares of the Sines, vntill you haue found out the iust number of the quotient if it be there) if not you must take the number of that Sine which is in value most nigh vnto it, whether it be a little more or lesse, it maketh no matter, and hauing found that number, looke in the front of that collum, and you shall find the Arke of your quotient

ent, standing right ouer the head of that collum, and also the minutes thereof in the first collum of the said Page on the left hand. As for example, hauing diuided one number by another, I finde the quotient to be 469|012. whereof I would know the arch, now in seeking this quotient amongst the Sines, I cannot finde that iust number, but I finde in the first Page, and in the tenth collum 469|015. which is the nighest number vnto it, that I can see. In the front of which collum I finde the Arke to be 4. degrees, and directly against that Sine on the left hand, I find 2'9. belonging to that arch, whereof that quotient is the Sinus, so as I gather hereof that the Arch of the foresaid quotiēt is 4. degrees, 2'9. But you haue to note by the way that the number of your quotient must neuer be much lesse then 1745. for otherwise it is not to be found in these tables, vnlesse you make the totall Sine to bee but 60|000. for then by reiecting the last two figures on the right hand, as I haue said before, the first right Sine of these tables shal be no more but 17. and by that account a very small quotient may be found in these tables. And whatsoeuer hath beene said here touching the order that is to be obserued in the 1. tables of Monte Regio, whose totall Sine is 6|000|000. the like in all pointes is to bee obserued in the last tables, whose totall Sine is 10|000|000. Thus much touching the order of the foresaid tables of Monte Regio Printed in Folio. But for almuch as those tables bee not altogether truely Printed, and for that they haue beene lately corrected, and made more perfect by Clauius, who hath set downe the same Tables in quarto and not in folio, whereby they are the more portable, and the more commodious, as well for that they are more truely printed as also for that the complement of euery arke is set downe in euery Page at the foot of euery collum, so as you need to spend no time in subtracting the Arke from 90. I thinke it good therefore to make a briefe description of those Tables, and the rather for that I haue requested the Printer to print the like here in quarto and I do worke all such conclusions as hereafter follow, by the said tables, the totall Sine whereof is 10|000|000. according to the last tables of Monte Regio. But for so much as some may haue already the Tables of Monte Regio Printed in Folio, not knowing perhaps the vse thereof, I will set downe two conclusions to bee wrought by those tables, and all the rest of the conclusi-

ons are to be wrought by those tables which I haue here caused to be Printed in quarto like to those of Clauius: and though the two conclusions next following, which are to shew the vse of the foresaid tables, may be wrought by the tables of Sines in what forme so euer they be truely Printed in folio, or in quarto, yet because I had appointed them to bee done by the Tables of Monte Regio, Printed in folio before that euer I saw Clauius his booke, I mind not now to alter them but to let them stand still as they are.

How to find out by the saide tables, the distance betwixt two places differing both in Longitude and Latitude, making the totall Sine to be no more but 60000.

THis is done by finding out two numbers, whereof the one is called in Latine Primum inuentum, that is to say, the first found number, & the other is called Secundū inuentum, that is the second found number in such order as followeth.

First then knowing the Longitude of either place, take the differēce of their Longitudes by subtracting the lesser Longitude out of the greater, that done, multiply the right Sine of that difference into the Sine of the complement of the lesser Latitude, and diuide the product of that Multiplication by the totall Sine, and then seeke out the arch of that quotient according to the rule before taught, so shall you haue the first found number: That done, multiply the right Sine of the lesser Latitude by the totall Sine, and hauing diuided the product thereof by the right Sine of the complement of the first found number, substract the arch of that quotient out of the greater Latitude, and you shall haue the second found number: Then multiply the right Sine of the complement of the first found number into the right Sine of the complement of the second found number, and hauing diuided the product of that Multiplycation by the totall Sine, seeke the Arke of that quotient in the tables, and take that Arke out of the whole Quadrant, and the degrées that doe remaine, are degrées of the great Circle, which if you multiply by 60. the product of ỹ Multiplication will shew you how many Italian miles the one place is distant from the other, or if you would haue Germane miles, thē multiply the foresaid degrées of the great Circle by 15. or else diuide the product

of

of the Italian miles by 4. and you shall haue your desire. As for example, you would know what distance is betwixt Hierusalem and Noremberg a famous towne in Germanie, Hierusalem according to Appian his tables, hath in Longitude 66. degrees, 0'. and in Latitude 31. degrees, 4'o. Againe Noremberg hath in Longitude 28. degrees, 2'o. and in Latitude 49. degrees, 2'4. the difference of their Longitudes is 37. degrees, 40'. the right Sine whereof is 36|664. for in this example Appian maketh 60|000. to be the totall Sine, & therefore he reiecteth the two last figures on the right hand found in the first tables of Monte Regio Now you must multiply 36|664. into the right Sine of the complement of the lesser Latitude which Sine is 51|067. the product of which two Sines being multiplied the one by the other, amounteth to 1|872|320|488. which if you diuide by the totall Sine 60|000. you shall finde in the quotient 31|205. whose arch is 31. degrees, 2'o and this shall be your first found number. This done, multiply the right Sine of the lesser Latitude which is 31|498. by the totall Sine 60|000. and the product thereof wil be 1|889|880|000. which summe if you diuide by the Sine of the complement of the first found number which Sine is 51|249. you shall finde in the quotient 36876. the Arke whereof is 37 degrees, 5'5. which arch being subtracted out of the greater Latitude, there will remaine 11. degrees, 2'9. and that shall be your second found number, then multiply the foresaid Sine of the complement of the first found number which is 51|249. by the Sine of the complement of the second found number which is 58|798. and the product thereof will amount to 3|013|338.702. which if you diuide by the totall Sine, you shall find in the quotient 50|222. the arch whereof is 56. degrees, 5'o. which being subtracted out of the whole Quadrant which is 90. degrees, there will remain 33. degrees, 1'o. of the greater Circle, which 33. degrees, if you multiply by 60. it will make 1980. miles, whereunto you must adde, for the 1'o. 10. miles, so shall you find the distance betwixt the two foresaide places to be 1990 Italian miles. which if you would reduce into Germaine miles, then diuide that number by 4. for 4. Italian miles doe make but one Germaine mile, so shall you haue 497. Germaine miles, and two Italian miles remaining, which is halfe a Germaine mile, which summe agreeth with that which

Appian

Appian setteth downe in his Geographie, whereas he vseth the selfe same example, and worketh it in like manner Per tabulas sinuum.

The Altitude of the sunne being knowne, how to find out the Longitude of the shadow both right and verse of any body yeelding shadow by helpe of the foresaid tables.

FIrst you haue to vnderstand, that euery bodily thing yelding shadow, is diuided into 12. equall partes, and euery such part into 60. minutes, and euery minute into 60 seconds, and so forth: Againe, of shadowes there be 2. kindes, that is, Vmbra recta, and Vmbra versa: Vmbra recta is that which proceedeth from some body rightly erected vppon the vpper face of the Horizon, as from some tower or post standing right vp vpon a leuel ground, And that shadow is called Vmbra versa, which proceedeth from some right style or pearch being thrust into a wall or post, standing right vp and not leaning, in such sort as the saide style or pearch may bee a iust paralell to the vpper face of the Horizon. Now to find out the length of either of the forsaide shadowes, you must doe thus.

Multiply the right Sine of the complement of the giuen Solar altitude, by 12. and diuide the product by the right Sine of the saide Solar altitude, and you shall haue the Longitude of the right shadow of the said body. Againe, if you multiply the right Sine of the foresaid altitude by 12. and diuide the product by the Sine of the complement of the said altitude, you shall haue the Longitude of Vmbra versa, of the said body. As for example, suppose the giuen Solar altitude to be 25. degrées, the complement wherof is 65. and the right Sine of that complement is 54|378. if you make the total Sine to be 60|000. Then in multiplying the foresaid right Sine by 12. the product will be 652|536. which if you diuide by the Sine of the altitude which is 25|357. you shal finde the longitude of Vmbra recta to be 25. parts 4'4.4" 2.€6'. Now if you multiply the Sine of the altitude which is 25|357 by 12, and diuide the product by the Sine of the complement, which is 54|378. you shall find the Longitude of Vmbra versa to bee 5. part. 6,3'5. and in saying here parte, I meane alwaies such partes

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as are the 12. parts, whereunto the body yeelding shadow is diuided: but if you worke this example by the first tables of Sines making the totall Sine 6/000/000. though you find it true in the parts and minutes, yet shall you not finde it so in the seconds and thirds, and if you worke the same by the second tables making the totall Sine 10/000/000. you shal find it to agree only in the parts, but neither in minutes nor secondes, which maketh me to suspect that the Printer hath committed some error therein, for both the tables were made by one selfe rule.

A briefe description of the tables of Sines Printed in quarto like vnto those which Clauius setteth downe in his commentaries vpon Theodosius his Spheriques.

HAuing here before plainely described vnto you the tables of sines made by Monte Regio, which are Printed in Folio, & how to vse the same, I will now briefly describe the said tables lately corrected by Clauius, & were Printed in quarto at Rome Anno 1586. the totall Sine of which tables according to the last table of Monte Regio, is 10/000/000. by which Tables are to be wrought all the conclusions hereafter following.

First then you haue to vnderstand that these tables are contained in 36. Pages, in the front whereof are set downe the degrees of the Quadrant proceeding from 1. to 89. but because the whole number of minutes belonging to the said degree, which is 6'0. can not be all placed in one selfe Page, but onely 3'0. in the left outermost collum of the left hand Page: and other 3'0. in the left outermost collum of the right hand Page: therefore ỳ degrees or arches of the Quadrant are faine to be twice repeated in the front of euery two Pages, as you may plainely see by viewing the said tables, and euery Page containeth seuen collums, whereof the first on the left hand containeth the minutes belonging to the degrees or arches of ỳ Quadrant, which minutes do proceed downeward from 1. to 3'0. and the seuenth collum on the right hand in euery Page containeth the minutes belonging to the complement of euery arch, which minutes do proceede backward, that is to say, from 1. set downe at the lowest end of the last collum of the second Page, and so proceeding vpward to 3'0. which 3'0. is also set

downe

downe at the lowest end of the last collum of the left hand Page, and so proceedeth vpward to 60. which 60. minutes doe helpe to make vp the complement that is answerable to euery arch whereunto no minutes be annexed, for if the arch hath no minutes, then you must adde to the complement thereof 60. minutes, which is one whole degree, to make vp the complement. As for example, suppose the Arke to be 46. degrees, without any minutes ioyned thereunto, the complement whereof set downe at the foote of the said Arch, is but 43. degrees, wherefore you must adde thereunto 60. which is one degree, so shall the complement be 44. degrees, which is the true complement indeed, but if you suppose the foresaid Arke to haue 13. ioyned thereunto you shall find the complement to be 43. degrees, 47. which is answerable to the foresaid Arke 46. degrees, and 13. for if you take 46. degrees, 13. out of 90. degrees, the remainder will be 43. degrees, 47. which is the complement, so as you neede not to make any Subtraction out of 90. to find the complement of any arch, that hath any minutes annexed thereunto: but whensoeuer you haue to finde out the right Sine of any complement in these tables, you must then make the complement an arch, seeking for the same in the front and not at the foote of the tables, & if the said complement haue any minutes annexed thereunto, you must seeke those minutes in the left outermost collum of euery Page, and not in the outermost right collum belonging to complements, for in this case the complement is an arch and not a complement The order of working by these tables in all other things differeth not one iotte from that which we haue obserued in working the two former conclusions by the tables of Monte Regio printed in Folio, as you shal easily perceiue by the examples here following.

1 How to find out the declination of the Sunne at any time his place in the Zodiaque being giuen, *Per tabulas Sinuum.*

KNowing the place of the Sun for the day, consider how much the said place is distant from the first point of Aries if ỹ place of the Sunne be nigher to Aries then to Libra But if it be nigher to Libra, then take his distance from the first point of Libra, which distance must not exceede 90. degrees, and seeke that distance amongst

mongst the Arkes in the Front of the Tables if they be degrees, if minutes, you shall finde them in the first collum on the left hand, then multiply the Sine of that distance by the Sine of the greatest declination which is 23. degrees, 28. and diuide the product therof by the totall Sine, and the quotient will shew you the Sine of the declination for that day, the arch whereof is the very number of the declination it selfe. As for example, you would know the declination of the Sunne the eleuenth of Aprill 1591. when as the Sunne was entred 3°3. into Taurus, vnto which you must adde according to the rule before giuen 30. degrees, for that is his distance from the first point of Aries, then seeke out the saide 30. degrées, in the front of the last Tables among the Arkes and the 3°3. in the first collum on the left hand, right against which you shall finde the Sine of the saide distance to bee 5082|901. which being multiplied by 3|982|155. (which is ♄ Sine of the greatest declination) the product thereof will be 20|240|890|631|655. which if you diuide by the totall Sine which is 10|000|000. you shall find the quotient to be 2|024|089. which quotient must be sought out in the said Tables, and if you finde no such number, then take the neerest number thereunto, which is 2025025. and the Arke thereof together with the minutes that stand right against the said quotient in the first collum on the left hand, is the declination of the Sunne for that day which is 11. degrees, 41.

2 How to know the right ascention of the Sunne, *Per tabulas Sinuum.*

FIrst knowing the Sunnes place, you shall learne the right ascention thereof thus. First consider how farre his place is from the Equinoctiall point, as is saide before in the last proposition, and multiply the Sine of the complement of that distance by the totall Sine, then knowing the declination of the Sunne for that day by the last rule, diuide the former product by the Sine of the complement of the said declination, and the quotient will shew the Sine of that Arke whereof the complement is the right ascention. As for example, ☉ Sunne being in the 3°3. of Taurus, and his declination 11. degrees, 41. as you found by the the last propositiō & his distance frō the first point of Aries to be in all 30. degrees 3°3.

the

the complement whereof is 59. degrees, 27. the Sine of which complement is 8|611|860. which being multiplied by the totall Sine which is 10|000|000. the product will be 86|116|600|000|000. which being diuided by the Sine of the complement of the Sunnes declination which is 78. degrees, 19. whoſe Sine is 97928 18. by which Sine if you diuide the former product, the quotient will bee 8|773|600. the Arke of which quotient is 61. degrees, and 19. and the complement of that is 28. degrees, and 41. which is the right aſcention of the place of the Sunne for the foreſaid day.

And here note, that if the Arke from Aries to the giuen pointe, doe containe iuſt 90. degrees, the right aſcention thereof is alſo 90. degrees, but if the ſaide Arke bee more then 90. degrees, and leſſer then 180. degrees, then ſubtract the ſame out of 180. and ſeeke out the right aſcention of the remainder as before, whoſe right aſcention if you take out of 180. the remainder ſhall bee the aſcention of the propounded Arke. But if the ſaide Arch which is comprehended betwixt Aries and giuen point, bee greater then 180. degrees, or 6. ſines, and leſſer then 270. degrees or 9. ſines, then hauing ſubtracted 180. degrees from the ſame arch, calculate the right aſcention of the arch from the beginning of Libra, as before, and the right aſcention thereof being added to 180. degrees, ſhall be the aſcention deſired.

Laſtly if the arch comprehended betwixt Aries and the point giuen, be greater then 270. degrees, or 9. ſines, then ſubtract the ſame out of 360. degrees, and ſeeke out the right aſcention of that remainder as before, which if you ſubtract out of 360. degrees, the remainder ſhall be the right aſcention deſired.

3 How to finde out the aſcentionall difference, *Per tabulas Sinuum.*

MUltiply the Sine of the Latitude giuen by the totall Sine, and diuide the product by the complemēt of the ſaid Latitude, that done, multiply the quotient by the Sine of the ſunnes declination, and diuide the product by the ſine of the complement of the declination, and the quotient thereof will ſhew the Sine of the aſcentional difference: and by working according to this rule, you ſhal find

that

that when the Sunne is entred 3′3. into Taurus, at which time his declination is 11. degrees, 4′1. (as haue beene ſaid before) the aſcentionall difference will be 15. degrees, 2′1. And here note that the aſcentionall differences for one quarter of the Circle ſerueth alſo for all the reſt, ſo that the Latitude be not altered, and that the declination of the points in the later quarters be equall to the declination of the points in the firſt quarter.

4 How to find out the oblique aſcention of any point of the Ecliptique in any Latitude aſsigned.

FIrſt finde the right aſcention of the giuen pointe by the ſecond propoſition, and alſo the aſcentionall difference thereof by the third propoſition: then conſider whether the declination of the ſaid point be Northward or ſouthward, for if it be Northward, then ſubtract the aſcentionall difference out of the right aſcention, & the remainder ſhall be the oblique aſcention deſired: but if the declination be Southward, then adde the aſcentionall difference vnto the right aſcention, and the ſumme ſhall be the oblique aſcention. In working thus for the Latitude 52. and ſuppoſe the Sunne to be in the 3′3. of Taurus, and hauing found by the former propoſition his right aſcention to be 28. degrees, 4′1. and the aſcentionall difference to be 15. degrees, 2′1. you ſhall find his oblique aſcention in the foreſaid Latitude to be 13. degrees, 2′0.

5 How to finde out the time of the Sunnes riſing and ſetting, and thereby the length of the artificiall day.

FIrſt you muſt know the aſcentionall difference, and conuert the ſame into howers & minutes, then if the Sunne be in any of the northern ſignes, adde thoſe howers to 6. howers, which is the one halfe of an Equinoctionall day, & the ſumme of ſuch Addition ſhal be the one halfe of ỳ artificiall day, which being ſubtracted out of 12. howers, the remainder ſhal be the hower of the Sunnes riſing: As for example, the Sunne being in the 3′3. of Taurus, you found the aſcentionall difference to be 15. degrees and 2′1. which being turned into howers maketh one hower 1′.″. and ſomewhat more, which being added to 6. maketh 7. howers 1′.″. and a little more,

which

which is the one halfe of the artificiall day which being doubled, maketh in all 14. howers 2′. and 4″. but if the Sunne be in any of the Southerne signes, you must remember to subtract the howers of the ascentionall difference out of 6. howers, and the remainder shall be the one halfe of the artificiall day, and by subtracting the halfe length of the artificiall day out of 12. you shall know the hower of the Sunnes rising, and hauing the time of his rising, you must néeds know the time of his setting.

6 How to finde out the Meridian altitude of the Sunne in any day though he doth not shine at all, the eleuation of the Pole being giuen.

SUbtract the eleuation of the pole from 90. and the remainder shall be the eleuation of the Equinoctiall, then if the Sunne be in any of the Northern signes, adde the declination of the Sunne, vnto the altitude of the Equinoctiall, or else if he be in any of the Southern signes, subtract the declination, and the summe of the Addition, or remainder of the Subtraction, shall shew the Meridian altitude. As for example, the second of May 1591. the sunne being in the 20. degrées, 42. of Taurus, and his declination Northward 17. degrées, 5′6. 2″1. here by subtracting 52. degrées, which is our Latitude from 90. you shall find the remainder to be 38. which is the altitude of the Equinoctiall, whereunto if you adde the Sunnes declination for that day which is 17. degrees, 5′6. and 2″1. the summe will be 55. degrées, 5′6. and 2″1. and that is the Meridian altitude of the Sunne for that day.

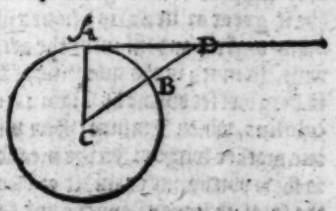
Let these few conclusions serue to shew you the vse of the Tables of Sines, for it would make a long booke to set downe so many conclusions as are to be wrought by these Tables, and therefore I leaue to trouble you any further therewith, minding now briefly to declare vnto you the vse of the Tables of lines Tangent and Secant by one example or two as followeth. But first I thinke it necessarie to shew you what those lines be, and whereto they serue.

THE

THE DESCRIPTION and vse of the Tables of Tangents and Secants.

EVclid in the second proposition of his third Booke defineth the line Tangent in this sort. A right line (saith he) is said to touch a circle whē it toucheth it so, as being drawn out in length, it would neuer cut the said Circle.

The line Secant is not by him any whet defined, but what these two lines are, you shall better vnderstand by this figure Demonstratiue here following, then by any definition that can be made thereof: for a definition ought to be plaine and briefe, and not long, intricate or doubtfull, which will be hardly performed in shewing the nature of these two lines by way of definition, and therefore marke well this figure following.



In this figure you see first a Circle drawne vpon the Centre C. from which Centre is extended to the circumference of the Circle, a right line called the Semidiameter, marked with the letters A. C. thē there is another right line which toucheth the said Circle, and also the outermost end of the said Semidiameter making therewith a right Angle in the point A. and is called the line Tangent, then there is a third line which proceeding from the Centre C. doth cut the circumference of the Circle in the point B. & also meeteth with the line Tangent in the point D. and therfore is called ỹ line Secant, betwixt which two lines, I meane the Tangent & Secant, is intercepted or included a certaine por-

tion or Arch of the foresaid Circle, lesse then a Quadrant marked with the letters A. B. of which Arke the line A. D. is the Tangent, and the line C. D. is the Secant thereof, which must nedes mete with the Tangent in the point D. because that the two Angles C. A. D. and D. C. A. are lesser then two right Angles, for the one is right, and the other sharpe, by reason that the Arke is lesse then a Quadrant. And some doe call the line Tangent the line Ascript, because it is ascribed to the Circle, & they call the line Secant the Hipothenuse, because it subtendeth the right Angle A, & they call the Semidiameter or totall Sine, the base of ỹ rectangle Triangle C. A. D. which is called a rectangle Triangle because it containeth one right Angle marked with the letter A. & note that whensoeuer any maner of Angle is propounded by three letters, that the middle letter doth alwaies signifie the Angle propounded, be it right, sharpe, or blunt. Now if you would know to what end the foresaid two lines were inuented, & whereto they serue, you haue to vnderstand that they chiefly serue in calculating the quantitie of Angles and their sides, as well in right lined Triangles as in spherical Triangles, for the sides of Triangles are either right or crooked, and if they haue right sides, such Triangles are either right angled Triangles, or oblique angled Triangles. And you haue to note that the quantitie of euery Angle is to be measured by the arch of a Circle subtending that angle, for the point of euery Angle is imagined to be the Centre of a whole Circle, which you may suppose to be so great or little as you will, for euery Circle (be it great or little) is deuided into 360. degrees, and loke how many degrees and minutes the arch subtending that Angle containeth, so much is the quantitie of that Angle, the practise whereof is very wel set downe by Clauius in his commentaries vpon Theodosius, which I minde (God willing) hereafter to translate into our mother tongue: In the meane time my intention here, is only to shew you by one example or two, the vse of the Tables made for the foresaid lines Tangent and Secant.

The vse of the said Tables according to Clauius, is thus.

IN seeking out the Tangent or Secant of any Arke giuen, or of the cõplement of any Arke by either of these Tables, you haue

to

to obſerue the ſelfe ſame order which you did before in finding out the right Sine of any Arke giuen, or of the complement of any Arke. Per tabulas ſinuum. As for example, if you would find out the Tangent of an Arke containing 50 degrées, 2'4. then reſort to the Table of Tangents; in the front wherof, take firſt for the Arke 50. degrees, and then in the firſt collum on the left hand of the ſaid table, for 2'4. right againſt which on the right hand vnder the Arke 50. you ſhall finde in the common Angle the Tangent to bee 12/087/923. the total Sine wherof is 10/000/000. but if you would find out the Secant of the foreſaid Arke 50. and 2'4. then you muſt reſort to the table of Secants, and hauing found out the Arke 50. in the front of the ſaid Tables, and the 2'4. on the left hand as before, you ſhall find in the common Angle the Secant to be 15688144. And if you would haue the Tangent of the complement of the ſaid Arke which is 39. degrees, and 3'6. you ſhall find the 39. degrees of the complement in the foot of the table of Tangents right vnder the Arke 0. & the 3'6. in the outermoſt collum on the right hand of the ſaide table, with which complement you muſt enter the table of Tangents, ſeeking for 39. degrées in the front of the table and 3'6. in the firſt collum on the left hand of the ſaid table, right againſt which in the common Angle, you ſhall finde 8272720. to be the Tangent of 39. degrees, 3'6. which is the complement of 50 degrees, 2'4.

And now muſt worke in like manner with the table of Secants: As for example, if you would find the Secant of 72 degrees, 3'6. firſt then enter the table of Secants, looking for 72. degrees, aboue in the front of the table, and 36. in the firſt collum on the left hand of the ſaide table, and in the common Angle you ſhall find 33/440/240. which is the Secant of 72. degrees, 3'6. But if you would haue the Secant of the complement of the ſaid arch 72. degrees, 3'6. then looking in the foote of the Table right vnder 72. degrees, you ſhall finde 17. degrees, and in the outermoſt collum on the right hand, iuſt againſt 3'6. you ſhall finde 2'4. ſo as you ſee that 17. degrees 2'4. is the complement of 72. degrees, 3'6. with which compelment you muſt enter the Table of Secants, looking for 17. degrees, aboue in the front of the Table, and for 2'4. in the firſt collum on the left hand of the ſaid tables, & in the comm̃ Angle you ſhall find 10/479/542. to bee the Secant of the arch 17

degrees.2'4.which is the complement of the arch 72.degrees,3'6

The vse of which tables in Astronomicall matters, I haue here set *downe as followeth.*

1 To finde out the declination of the Sunne, the place thereof being knowne.

MUltiply the Secant of the complement of the greater declination by the totall sine, & deuide the product by the sine of the Suns distance frō one of the Equinoctiall points, the quotient is the Secant of an arch, whose complement is the declination of the Sun: for example, suppose that the sunne be entering into ♈ to finde the declination therof first I multiply 25112030. the Secant of 66. degrees 32. (which is the complement of 23.degrees 28.the greatest declination) by 10000000.the product is 251120300000000.which being deuided by 5000000.(the sine of 30.degrees the Sunnes distance from the Equinoctiall point) the quotient is 50224060.for which number I seeke in the Table of Secants, the arch answering vnto it, is 78.degr.32.the complement whereof is 11.degrees 29.which is the declination of the Sunne.

2 Knowing the declination of the Sunne how to find his distance from the Equinoctial point, and so consequently his place in the Zodiake.

MUltiply the Secant of the complement of the greatest declination by the totall sine, & deuide the product by the Secant of the complement of the declination giuen, the quotient is the distance of the Sun from the Equinoctiall point. As for example, the declination of the sun is supposed to be 11.degrees 29.then to finde

find his distance from the Equinoctiall, I multiply 251120300. the Secant of 66. degrees. 3'2. (which is the complement of the greatest declination) by the totall sine the product is 25112030000000. which I diuide by 50224350, the Secant is 78. degr. 3'1. the complement of 11 degrees 2'9. the supposed declination, the quotient is 5000000. the sine whereof is 30. degrees 0'. which is the distance of the Sunne from the Equinoctiall: then for his place you must take the same according to the season of the yeare for if it be in Aprill, then the Sunne is entring into Taurus, but if it be in August it is entering into Virgo, and being in October. it is entering into Scorpio, and being in Febuarie it is in the beginning of Pisces.

3 To find out the right ascention of the Sunne.

MUltiply the Tangent of the distance of the Sunne from the Equinoctiall point which is nearest vnto it, by the signe of the complement of the greatest declination, and diuide the product by the totall signe, the quotient is the Tangent of the right ascention of the Sunne, for which if you seeke in the Table of Tangents, the arch answering vnto it is your desire: For example the Sunne being in the first of Taurus, to knowe the right ascention thereof, I multiply 5773502. the Tangent of 30. degrees (for that 30. degrees is the distance of the Sun from the Equinoctial point) by 91729 20. the sine of 66. degrees 3'2, which is the complement of 23. degrees 2'8, the greatest declination, the product is 529598719658 40. which being deuided by 10000000. the totall sine, the quotient is 5295987. which is the Tangent of 27. degrees, 5'4. which is the right ascention of the Sunne being entered into Taurus.

4 How to finde out the declination of the Sunne knowing onely the right ascention thereof,

MUltiply the Tangent of the complement of the greatest declination by the totall sine, and diuide the product by the sine of the right ascention giuen, the quotient is the Tangent of the complement of the Sunnes declination: for example the right as-

cention of the Sunne being 27. degrees 5'4. I would know the declination thereof, multiplying 23035062. the Tangent of 66 degrees 3'2. the complement of 23, degrees 2'8, by 10000000. the product is 230350620000000. which being deuided by 4679298. the signe of the giuen ascention the quotient is 49224856. the arch of which Tangent is 78. degrees 3'2. which being subducted out of 90. the remainder is 11, degrees 2'8, and somuch is the declination of the Sunne.

5 How to finde the place of the Sunne knowing onely the right ascention thereof.

SUbduct the right ascention giuen out of 90. if it be lesse then 90 but if the same bee more then 90. subtract the ascention giuen out of 180. and being greater then 180. subduct the same out of 270, or being greater then 270, subduct the same from 360. and multiply the Tangent of the remainder by the sine of the complement of the greatest declination, and deuide the product by the totall sine, the quotient is the Tangent of the complement of the Suns distance from one of the Equinoctiall points: which distance beeing knowne, the place of the Sunne can not be knowne. For example, supposing the right ascention of the Sun to be 27, degrees 5'4. the complement thereof is 62, degrees 6'. the Tangent whereof is 18886715. which being multiplied by 9172920. the product is 173245985757800. which beeing deuided by 10000000 the quotient is 17324598. for which I looke in the table of Tangents, and I finde the arch thereof to bee 60, the complement wherof is 30, which is the distance of the Sunne from the Equinoctiall point, that is from Aries, for that the right ascention is lesse then 90. I say then that the Sunne is in the beginning of Taurus. But if the right ascention had beene more then 90, and lesse then 180, the place of the Sunne had beene betwixt Cancer and Libra 30. degrees from Libra, so should it haue beene in the first point of Virgo, but if the right ascention had beene more then 180, the place of the Sunne should be betwixt Libra and Capricorne, that is in the beginning of Scorpio, but being more then 270. the place of the Sun should be betwixt Capricorne and Aries, that is in the beginning of Pisces.

6 To finde out the ascentional difference of the Sunne or any starre in the firmament, knowing the declination thereof, and also the Latitude of your Region.

MUltiply the Tangent of the declination of the sunne or starre by the Tangent of the Latitude of the place, and diuide the product by the totall sine: the sine of the quotient is the sine of the ascentionall difference, the arch whereof is the desired ascentionall difference. For example let the declination of the Sunne starre, or other point in the firmament bee 10. degrees 3′. and suppose the latitude to be 52. degrees, the Tangent of 10. degrees 3. is 1772268. the Tangent of 52. degrees, is 12799416. which being multiplied together, the product will be 22674995395488. which being deuided by 10000000. the totall sine, the quotient is 22674995. for which number I looke amongst the sines, the arch answering thereunto is 13. degrees 6′ which is the ascentionall difference desired.

7 To find out the oblique ascention of the Sunne

KNowing the place of the Sunne, find out the right ascention of the same by the third proposition, and find also the ascentionall difference of the same point, then if the declination of the Sun be North, subduct the ascentionall difference out of the right ascention, the remainder is the oblique ascention. For example, suppose the Sunne to be in the beginning of Taurus, now to find the oblique ascention thereof in the Latitude of 52 degrees, first by the third proposition I find out the right ascention of the beginning of Taurus, which I finde to be 27. degrees 5′4. then by the sixth proposition I finde the ascentionall difference to be 15. degrees 4 which being subducted from 27. degrees 5′4. (for that the declination is North) the right ascention the remainder is 12. degrees 5′0. so much is the oblique ascention for the latitude of 52. degrees. But if the Sunne be in any of the Southern sines, and that the declination be South, then the ascentionall difference is to bee added to the right ascention before giuen.

8 To find out the oblique descention of the Sunne at any time.

FIrst find out the right ascention of the Sunne be the third proposition, the same shall bee the right descention thereof, then finde the ascentionall difference by the first proposition, and if the Sun be in any of the Northerne signes, adde the ascentionall difference vnto the right ascention, the summe shall be the oblique descention of the Sunne: but if it be in any of the Southerne signes, subduct the ascentionall difference out of the right ascention, the remainder is the desired descention: as for example the sunne being in the beginning of Taurus, the right ascention thereof by the third proposition is 27. degrees 5′4. the ascentionall difference thereof by the sixth proposition is 15. degrees 4′. for as much then as Taurus is a Northerne signe, I adde the ascentionall difference vnto the right ascention, the summe is 24. degrees 5′8. so much is the oblique descention of the Sunne being in the beginning of Taurus

9 To find out the length of the day or night.

HAuing found out the ascentionall difference by the sixth proposition, adde the same vnto 90. if the Sunne be in any of the Northerne signes, but if it be in any of the Southerne signes, subduct the ascentionall difference out of 90. then diuide the summe of the addition or the remainder of the subtraction by 15. the quotient will shew the halfe length of the day in houres and minutes which being doubled you shall haue the whole length of the artificiall day: For example the Sunne being in the beginning of Taurus, the ascentionall difference thereof is 15. degrees 4′. which for that the Sunne is in a Northerne signe, I adde vnto 90. degrees, the summe is 105. degrees 4′. which being deuided by 15. the quotient is 7 houres 0′. the halfe length of the day which being doubled will be 14. houres the whole length of the artificiall day in the Latitude of 52. degrees.

10. To finde the houre of the Sunne his rising or setting in the Latitude assigned.

HOw to find out the halfe length of the artificiall day by the 9. proposition, and subtract the same frō 12. houres, the remainder will

will shew the houre of the sunnes rising, for example the Sun being in the beginning of Taurus to know the houre of his rising in the Latitude of 52. degrees, by the ninth proposition, the halfe length of the artificiall day I finde to bee 7. houres, which I subtract from 12 houres the remainder is 5. which sheweth that the Sun riseth at 5. of the clocke in the Morning but the halfe length of the day it selfe is the houre of Sunnes setting.

11 To find out the length of the planetarie houres & to find what Planet raigneth at any houre of the day.

FIrst find out the length of the artificiall day by the ninth proposition, and divide the same by 12. the quotient is the length of one planetarie houre: for thus, having an houre of the artificiall day given, looke what houre the same is from the Sunne rysing, and multiply the same by 12, divide the product by the length of the artificiall day, the quotient is the number of the Planetarie houre. For example the sunne being in the beginning of Taurus and our Latitude being 52. degrees, the length of the artificiall day by the ninth proposition is 14. houres: then doe I devide 14. by 12. the quotient is $1\frac{1}{6}$. that is 1. houre 10. the length of one Planetarie houre. But if an houre of the artificiall day be given as that I would know what Planetarie houre it is at 9. of the clocke the Sunne being in the first of Taurus in the Latitude of 52. degrees, having found that the Sunne riseth at five of the clocke by the tenth proposition, I see that 4. houres of the artificiall day are gone at nine of the clocke, I therefore multiply 12. by 4. the product is 48. which I divide by 14. the length of the artificiall day, the quotient is $3\frac{3}{7}$. which is the Planetarie houre at the time set downe. Likewise shall you find the Planetarie houre of the night, finding the length thereof, and then worke with it as was shewed before for the day.

Now to know what Planet raigneth at any houre of the day or night is plainely set downe in the 52. Chapter which is the last Chapter of my second booke of the Sphеare.

12 To finde the arch of the Equinoctial, comprehended betwixt the Meridian and any Circle of position according vnto Campanus and Gazula.

MUltiply the Sine of the complement of your Latitude by the Tangent of the distance of the giuen Circle of position from the Zenith, and diuide the product by the totall Sine, the quotient is the Tangent of the Arch of the Equinoctiall, which is comprehended betwixt the giuen Circle of position, and the Meridian. For example in the Latitude of 52. I would know what part of the Equinoctiall is comprehended betwixt the Meridian and that Circle of position, which is 30. degrees from the Zenith: the Latitude being 52. degrees, the complement thereof is 38. degrees the Sine whereof is 6156615. and the Tangent of 30. degrees (for that 30. is the distance betwixt the giuen Circle of Position and the Zenith) is 5773502, which being multiplied by 6156615. the product is 35545229015730. which beeing diuided by 10000000, the totall Sine, the quotient is 3554522, for which I seeke among the Tangents, and I finde the Arke aunswering thereunto to be 19. degrees 3'4. the Arch of the Equinoctiall, betwixt the Meridian and the giuen Circle of position.

13 Knowing the Latitude of your Region, and also the Eleuation of the Pole aboue any Circle of position, how to find the inclination of the said Circle of position vnto the Meridian, and so consequently the Arch of the Equinoctiall, which is betwixt the said Circle of position and the Meridian.

MUltiply the Secant of the complement of the eleuation of the Pole aboue the Circle of position by the Sine of your Latitude, and deuide the product by the totall Sine, the quotient is the Secant of the complement of the inclination of the circle of position vnto the Meridian, and that is the distance betwixt the Circle of Position and the Zenith, by helpe whereof you shall finde the Arch of the Equinoctiall, betwixt the Circle of Position and the Meridian, as in the former proposition. As for example, suppose the eleuation of the Pole aboue the Circle of position, in our Latitude of 52, to bee 23. degrees 1'2. Now to find out the Inclinatiō of

of that Circle of Position vnto the Meridian, first I multiply 25384445. the Secant of 66. degrees 48. (for that is the complement of 23. degrees 12. the eleuation of the Pole aboue the Circle of position) by 7880108 the Sine of 52 the Latitude of our Region, the product is 200032168120060. which being diuided by 10000000. the quotient is 20003216. for which I looke in the Table of Secants and the Arch thereof is 60. degrees 0'. the complement whereof is 30. degrees 0'. which is the Inclination of the Circle of position vnto the Meridian, or the distance of the Zenith from the said Circle, then to finde the Arch of the Equinoctiall betwixt the said Circle of Position and the Meridian, repeate the worke of the former proposition.

14 To find out the Eleuation of the Pole aboue any assigned Circle of Position in any giuen Latitude.

KNowing the Inclination of the assigned Circle of Position vnto the Meridian, Multiple the Secant of the complement thereof by the totall Sine, and diuide the product by the Sine of your Latitude, the quotient is the Secant of the complement of the Eleuation of the Pole aboue the giuen Circle of Position: as for example, suppose the inclination of a Circle of position to bee 30. degrees 0'. Now to finde the eleuation of the Pole aboue the same for the Latitude of 52. degrees 0'. First take the complement of 30. degrees 0' which is 60. degrees 0'. the Secant whereof is 20000000. which being multiplyed by the totall Sine the product is 200000000000000, which being diuided by 7880108. the Sine of 52. the assigned Latitude, the quotient is 2580362. for which I seeke in the Table of Secants, and the Arch aunswering thereunto I find to be 66. degrees 48. the complement whereof is 23. degrees 12. and so much is the Eleuation of the Pole aboue the assigned Circle of Position in your Latitude.

Thus much touching the vse of the Tables of Sines, Tangents and Secants, now here followeth the three Tables, first the Table of Sines, secondly the Table of Tangents, and thirdly the Table of Secants

FINIS.

HERE FOLLOVVETH THE TABLE OF RIGHT SINES FOR EVERIE MINVTE OF THE QVADRANT, FIRST CALCVLATED BY I. *REGIO MONTANVS*, BVT NOW EXAMINED AND IN MANY PLACES CORRECTED AND AMENDED BY *CLAVIVS*.

The Table of Sines.

The degrees of the Quadrant for the right Sines.

	0	1	2	3	4	5
0	0000	174524	348995	523360	697565	60
1	2909	177433	351902	526265	700467	59
2	5818	180341	354809	529170	703369	58
3	8727	183250	357716	532075	706270	57
4	11636	186158	360623	534980	709172	56
5	14544	189066	363530	537884	712073	55
6	17453	191975	366437	540789	714975	54
7	20362	194883	369344	543694	717876	53
8	23271	197792	372251	546598	720777	52
9	26180	200700	375158	549503	723678	51
10	29088	203608	378064	552407	726579	50
11	31997	206517	380971	555312	729480	49
12	34906	209425	383878	558216	732381	48
13	37815	212333	386785	561120	735282	47
14	40724	215241	389692	564024	738183	46
15	43632	218149	392598	566928	741084	45
16	46541	221057	395505	569832	743985	44
17	49450	223965	398412	572736	746886	43
18	52359	226873	401318	575640	749787	42
19	55268	229781	404225	578544	752688	41
20	58177	232689	407131	581448	755588	40
21	61086	235597	410038	584352	758489	39
22	63995	238505	412944	587256	761389	38
23	66904	241413	415851	590160	764290	37
24	69813	244321	418757	593064	767190	36
25	72721	247229	421663	595967	770090	35
26	75630	250137	42457c	598871	772991	34
27	78539	253045	427476	601775	775891	33
28	81448	255953	430382	604678	778791	32
29	84357	258861	433288	607582	781691	31
30	87265	261769	436194	610485	784591	30
	89	88	87	86	85	

The numbers of degrees of the Quadrant for the right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines.

of the Arches of the same Quadrant.

	0	1	2	3	4	
30	87265	261769	436194	610485	784591	30
31	90174	264677	439100	613389	787491	29
32	93083	267585	442006	616292	790391	28
33	95992	270493	444912	619196	793291	27
34	98901	273401	447818	622099	796191	26
35	101809	276308	450724	625002	799090	25
36	104718	279216	453630	627905	801990	24
37	107627	282124	456536	630808	804889	23
38	110536	285032	459442	633711	807789	22
39	113445	287940	462348	636614	810688	21
40	116353	290847	465253	639517	813587	20
41	119262	293755	468159	642420	816486	19
42	122171	296663	471065	645323	819385	18
43	125079	299570	473970	648226	822284	17
44	127988	302478	476876	651129	825183	16
45	130896	305385	479781	654032	828082	15
46	133805	308293	482687	656934	830981	14
47	136714	311200	485592	659837	833880	13
48	139622	314108	488498	662739	836778	12
49	142531	317015	491403	665642	839677	11
50	145439	319922	494308	668544	842576	10
51	148348	322830	497214	671447	845474	9
52	151257	325737	500119	674349	848372	8
53	154165	328645	503024	677251	851271	7
54	157074	331552	505929	680153	854169	6
55	159982	334459	508834	683055	857067	5
56	162891	337367	511740	685957	859965	4
57	165799	340274	514645	688859	862863	3
58	168708	343181	517550	691761	865761	2
59	171616	346088	520455	694663	868659	1
60	174524	348995	523360	697565	871557	0
	89	88	87	86	85	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines.

	5	6	7	8	9	
0	871557	1045285	1218693	1391731	1564345	60
1	874455	1048178	1221580	1394612	1567218	59
2	877353	1051071	1224467	1397492	1570091	58
3	880250	1053964	1227354	1400373	1572964	57
4	883148	1056857	1230241	1403253	1575837	56
5	886045	1059749	1233128	1406133	1578709	55
6	888943	1062642	1236015	1409013	1581581	54
7	891840	1065534	1238901	1411893	1584453	53
8	894737	1068426	1241788	1414772	1587325	52
9	897634	1071318	1244674	1417652	1590197	51
10	900531	1074210	1247560	1420531	1593069	50
11	903428	1077102	1250446	1423410	1595941	49
12	906325	1079994	1253332	1426289	1598812	48
13	909222	1082886	1256218	1429168	1601684	47
14	912119	1085778	1259104	1432047	1604555	46
15	915506	1088669	1261990	1434926	1607426	45
16	917913	1091561	1264876	1437805	1610297	44
17	920809	1094452	1267761	1440684	1613168	43
18	923706	1097344	1270647	1443562	1616038	42
19	926602	1100235	1273532	1446441	1618909	41
20	929498	1103126	1276417	1449319	1621779	40
21	932395	1106017	1279302	1452197	1624649	39
22	935291	1108908	1282187	1455075	1627519	38
23	938187	1111799	1285072	1457953	1630389	37
24	941083	1114690	1287957	1460831	1633159	36
25	943979	1117580	1290841	1463708	1636129	35
26	946875	1120471	1293726	1466586	1638999	34
27	949771	1123361	1296610	1469463	1641868	33
28	952667	1126252	1299495	1472340	1644738	32
29	955563	1129142	1302378	1475217	1647607	31
30	958458	1132032	1305262	1478094	1650476	30
	84	83	82	81	80	

The minutes of the degrees of the Quadrant for the right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines.

of the Arches of the same Quadrant.

	5.1	6	7	8	9	
30	958458	1132032	1305262	1478094	1650476	30
31	961354	1134922	1308146	1480971	1653345	29
32	964249	1137812	1311030	1483848	1656214	28
33	967144	1140702	1313914	1486724	1659082	27
34	970039	1143592	1316798	1489601	1661951	26
35	972934	1146482	1319681	1492477	1664819	25
36	975829	1149372	1322564	1495353	1667687	24
37	978724	1152262	1325447	1498229	1670555	23
38	981619	1155151	1328330	1501105	1673423	22
39	984514	1158040	1331213	1503981	1676291	21
40	987408	1160929	1334096	1506857	1679159	20
41	990303	1163818	1336979	1509733	1682027	19
42	993198	1166707	1339862	1512608	1684894	18
43	996092	1169596	1342744	1515484	1687761	17
44	998987	1172485	1345627	1518359	1690628	16
45	1001881	1175374	1348509	1521234	1693495	15
46	1004775	1178263	1351392	1524109	1696362	14
47	1007669	1181151	1354274	1526984	1699229	13
48	1010563	1184040	1357156	1529859	1702095	12
49	1013457	1186928	1360038	1532734	1704962	11
50	1016351	1189816	1362920	1535608	1707828	10
51	1019245	1192704	1365802	1538482	1710694	9
52	1022139	1195592	1368683	1541356	1713560	8
53	1025032	1198480	1371564	1544230	1716426	7
54	1027926	1201368	1374446	1547104	1719292	6
55	1030819	1204255	1377327	1549978	1722157	5
56	1033713	1207143	1380208	1552852	1725022	4
57	1036606	1210031	1383089	1555725	1727887	3
58	1039499	1212918	1385970	1558599	1730752	2
59	1042392	1215806	1388851	1561472	1733617	1
60	1045285	1218693	1391731	1564345	1736482	0
	84	83	82	81	80	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the first Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Sines.

The degrees of the Quadrant for right Sines.

	10	11	12	13	14	
0	1736482	1908090	2079117	2249511	2419219	60
1	1739347	1910945	2081962	2252345	2422041	59
2	1742211	1913800	2084807	2255179	2424863	58
3	1740575	1916655	2087652	2258013	2427685	57
4	1747939	1919510	2090497	2260847	2430507	56
5	1750803	1922365	2093342	2263680	2433329	55
6	1753667	1925220	2096186	2266513	2436150	54
7	1756531	1928074	2099030	2269346	2438971	53
8	1759394	1930928	2101874	2272179	2441792	52
9	1762258	1933782	2104718	2275012	2444613	51
10	1765121	1936636	2107562	2277844	2447434	50
11	1767984	1939490	2110405	2280676	2450254	49
12	1770847	1942344	2113248	2283508	2453074	48
13	1773710	1945197	2116091	2286340	2455894	47
14	1776573	1948050	2118934	2289172	2458714	46
15	1779435	1950903	2121777	2292004	2461533	45
16	1782298	1953756	2124620	2294835	2464352	44
17	1785160	1956609	2127462	2297666	2467171	43
18	1788022	1959462	2130304	2300497	2469990	42
19	1790884	1962314	2133146	2303328	2472809	41
20	1793746	1965166	2135988	2306159	2475628	40
21	1796608	1968018	2138830	2308989	2478446	39
22	1799469	1970870	2141671	2311819	2481264	38
23	1802331	1973722	2144512	2314649	2484082	37
24	1805192	1976574	2147353	2317479	2486900	36
25	1808053	1979425	2150194	2320309	2489717	35
26	1810914	1982276	2153035	2323138	2492534	34
27	1813774	1985127	2155876	2325967	2495351	33
28	1816634	1987978	2158716	2328796	2498168	32
29	1819495	1990829	2161556	2331625	2500984	31
30	1822355	1993679	2164396	2334454	2503800	30
	79	78	77	76	75	

The degrees of the Quadrant for right Sines.

The numbers of the degrees of the Quadrant for right Sines of the Arches of the first Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the right Sines of the Arches of the same Quadrant.

	10	11	12	13	14	
30	1822355	1993679	2164396	2334454	2503800	30
31	1825215	1996530	2167236	2337282	2506616	29
32	1828075	1999380	2170076	2340110	2509432	28
33	1830935	2002230	2172916	2342938	2512248	27
34	1833795	2005080	2175755	2345766	2515064	26
35	1836654	2007930	2178594	2348598	2517879	25
36	1839513	2010780	2181433	2351421	2520694	24
37	1842372	2013629	2184272	2354248	2523509	23
38	1845231	2016478	2187111	2357075	2526324	22
39	1848090	2019327	2189949	2359902	2529138	21
40	1850949	2022176	2192787	2362729	2531952	20
41	1853808	2025025	2195625	2365555	2534766	19
42	1856666	2027874	2198463	2368381	2537580	18
43	1859524	2030722	2201300	2371207	2540393	17
44	1862382	2033570	2204137	2374033	2543206	16
45	1865240	2036418	2206974	2376859	2546019	15
46	1868098	2039266	2209811	2379684	2548832	14
47	1870956	2042114	2212648	2382509	2551645	13
48	1873813	2044962	2215485	2385334	2554458	12
49	1876670	2047809	2218322	2388159	2557270	11
50	1879527	2050656	2221158	2390983	2560082	10
51	1882384	2053503	2223994	2393808	2562894	9
52	1885241	2056350	2226830	2396632	2565706	8
53	1888098	2059197	2229666	2399456	2568517	7
54	1890954	2062043	2232502	2402280	2571328	6
55	1893810	2064889	2235337	2405104	2574139	5
56	1896666	2067735	2238172	2407927	2576950	4
57	1899522	2070581	2241007	2410750	2579760	3
58	1902378	2073427	2243841	2413573	2582570	2
59	1905234	2076273	2246672	2416396	2585380	1
60	1908090	2079117	2249511	2419219	2588190	0
	79	78	77	76	75	

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant

of the complements of the Arches of the same Quadrant

The Table of Sines.

The degrees of the Quadrant for the Sines.

	15	16	17	18	19	
0	2588190	2756373	2923717	3090170	3255682	60
1	2591000	2759169	2926499	3092936	3258532	59
2	2593809	2761965	2929280	3095702	3261183	58
3	2596618	2764761	2932061	3098468	3263931	57
4	2599427	2767556	2934842	3101234	3266681	56
5	2602236	2770351	2937623	3103999	3269430	55
6	2605045	2773146	2940403	3106764	3272179	54
7	2607853	2775941	2943183	3109529	3274927	53
8	2610661	2778735	2945963	3112294	3277675	52
9	2613469	2781529	2948743	3115058	3280423	51
10	2616277	2784323	2951523	3117822	3283171	50
11	2619084	2787117	2954302	3120586	3285918	49
12	2621891	2789911	2957081	3123349	3288665	48
13	2624698	2792704	2959860	3126112	3291412	47
14	2627505	2795497	2962638	3128875	3294159	46
15	2630312	2798290	2965416	3131638	3296905	45
16	2633118	2801082	2968194	3134400	3299652	44
17	2635924	2803874	2970972	3137162	3302398	43
18	2638730	2806666	2973750	3139924	3305144	42
19	2641536	2809458	2976527	3141686	3307889	41
20	2644342	2812250	2979304	3145448	3310634	40
21	2647147	2815041	2982081	3148209	3313379	39
22	2649952	2817823	2984857	3150970	3316123	38
23	2652757	2820623	2987633	3153731	3318867	37
24	2655562	2823414	2990409	3156491	3321611	36
25	2658366	2826204	2993185	3159251	3324355	35
26	2661170	2828994	2995960	3162011	3327098	34
27	2663974	2831784	2998735	3164770	3329841	33
28	2666777	2834574	3001510	3167529	3332585	32
29	2669580	2837364	3004284	3170288	3335327	31
30	2672383	2840153	3007058	3173047	3338069	30
	74	73	72	72	70	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complents of the Arches of the same Quadrant.

The degrees of the Quadrant for right Sines.

of the Arches of the same Quadrant.

	15	16	17	18	19	
30	2672383	2840153	3007058	3173047	3338069	30
31	2675186	2842942	3009832	3175805	3340811	29
32	2677989	2845731	3012606	3178563	3343553	28
33	2680792	2848520	3015380	3181321	3346294	27
34	2683595	2851308	3018153	3184079	3349035	26
35	2686397	2854096	3020926	3186837	3351776	25
36	2689199	2856884	3023699	3189594	3354516	24
37	2692001	2859672	3026472	3192351	3357256	23
38	2694802	2862459	3029244	3195108	3359996	22
39	2697603	2865246	3032016	3197864	3362736	21
40	2700404	2868033	3034788	3200620	3365475	20
41	2703205	2870819	3037559	3203375	3368214	19
42	2706005	2873605	3040330	3206130	3370953	18
43	2708805	2876391	3043101	3208885	3373691	17
44	2711605	2879177	3045872	3211640	3376429	16
45	2714405	2881963	3048643	3214395	3379167	15
46	2717204	2884748	3051413	3217150	3381905	14
47	2720003	2887533	3054183	3219904	3384642	13
48	2722802	2890318	3056953	3222658	3387379	12
49	2725601	2893103	3059723	3225412	3390116	11
50	2728400	2895888	3062492	3228165	3392852	10
51	2731198	2898672	3065261	3230918	3395588	9
52	2733996	2901456	3068030	3233671	3398324	8
53	2736794	2904240	3070798	3236423	3401060	7
54	2739592	2907023	3073506	3239175	3403795	6
55	2742389	2909806	3076334	3241927	3406530	5
56	2745186	2912589	3079102	3244679	3409265	4
57	2747983	2915371	3081869	3247430	3411999	3
58	2750780	2918153	3084636	3250181	3414733	2
59	2753577	2920935	3087403	3252932	3417467	1
60	2756373	2923717	3090170	3255682	3420201	0
	74	73	72	71	70	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines

	20	21	22	23	24	
0	3420201	3583679	3746066	3907311	4067366	60
1	3422934	3586395	3748763	3909989	4070023	59
2	3425667	3589110	3751460	3912666	4072680	58
3	3428400	3591825	3754156	3915343	4075337	57
4	3431133	3594540	3756852	3918020	4077993	56
5	3433865	3597254	3759548	3920696	4080649	55
6	3436597	3599968	3762243	3923372	4083305	54
7	3439329	3602682	3764938	3926048	4085960	53
8	3442060	3605395	3767633	3928723	4088615	52
9	3444791	3608108	3770327	3921398	4091269	51
10	3447522	3610821	3773021	3934072	4093923	50
11	3450253	3613533	3775715	3936746	4096577	49
12	3452983	3616245	3778408	3939420	4099231	48
13	3455713	3618957	3781101	3942093	4101884	47
14	3458442	3621669	3783794	3944766	4104537	46
15	3461171	3624380	3786486	3947439	4107189	45
16	3463900	3627091	3789178	3950112	4109841	44
17	3466629	3629802	3791870	3952784	4112493	43
18	3469357	3632512	3794562	3955456	4115144	42
19	3472085	3635222	3797253	3958128	4117795	41
20	3474813	3637932	3799944	3960799	4120446	40
21	3477540	3640642	3802635	3963470	4123096	39
22	3480267	3643351	3805325	3966140	4125746	38
23	3482994	3646060	3808015	3968810	4128395	37
24	3485721	3648768	3810704	3971480	4131044	36
25	3488447	3651476	3813393	3974149	4133693	35
26	3491173	3654184	3816082	3976818	4136341	34
27	3493899	3656892	3818771	3979487	4138989	33
28	3496624	3659599	3821459	3982155	4141637	32
29	3499349	3662306	3824147	3984823	4144285	31
30	3502075	3665012	3826834	3987491	4146932	30
	69	68	67	66	65	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines.

The minutes of degrees of the Quadrant for right Sines of the Arches of the ſame Quadrant.

	20	21	22	23	24	
30	3502075	3665012	3826834	3987491	4146932	30
31	3504799	3667718	3829521	3990159	4149579	29
32	3507528	3670424	3832208	3992826	4151226	28
33	3510247	3673130	3834895	3995493	4154872	27
34	3512971	3675835	3837581	3998159	4157518	26
35	3515694	3678541	3840267	4000825	4160163	25
36	3518417	3681246	3842953	4003491	4162808	24
37	3521140	3683951	3845638	4006156	4165453	23
38	3523862	3686655	3848323	4008821	4168097	22
39	3526584	3689359	3851008	4011486	4170741	21
40	3529306	3692062	3853692	4014150	4173385	20
41	3532027	3694765	3856376	4016814	4176028	19
42	3534748	3697468	3859060	4019478	4178671	18
43	3537469	3700170	3861743	4022141	4181313	17
44	3540190	3702872	3864426	4024802	4183955	16
45	3542910	3705574	3867109	4027467	4186597	15
46	3545630	3708276	3869791	4030130	4189239	14
47	3548350	3710977	3872473	4032792	4191880	13
48	3551070	3713678	3875155	4035454	4194521	12
49	3553789	3716379	3877837	4038115	4197162	11
50	3556508	3719080	3880518	4040776	4199802	10
51	3559227	3721780	3883199	4043437	4202442	9
52	3561945	3724480	3885880	4046097	4205081	8
53	3564663	3727179	3888560	4048757	4207720	7
54	3567380	3729878	3891240	4051416	4210359	6
55	3570097	3732577	3893919	4054075	4212997	5
56	3572814	3735275	3896598	4056734	4215635	4
57	3575531	3737975	3899277	4059392	4218273	3
58	3578247	3740671	3901955	4062050	4220910	2
59	3580963	3743369	3904633	4064708	4223547	1
60	3583679	3746066	3907311	4067366	4226183	0
	69	68	67	66	65	

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the ſame Quadrant,

of the complements of the Arches of the ſame Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines

	25	26	27	28	29	
0	4226183	4383712	4539905	4694716	4848096	60
1	4228819	4386326	4542497	4697284	4850640	59
2	4231455	4388940	4545088	4699852	4853184	58
3	4234090	4391554	4547679	4702419	4855727	57
4	4236725	4394167	4550270	4704986	4858270	56
5	4239360	4396780	4552860	4707553	4860812	55
6	4241994	4399392	4555450	4710119	4863354	54
7	4244628	4402004	4558039	4712685	4865895	53
8	4247262	4404616	4560628	4715250	4868436	52
9	4249895	4407227	4563216	4717815	4860977	51
10	4252528	4409838	4565804	4720380	4873517	50
11	4255161	4412449	4568392	4722944	4876057	49
12	4257793	4415059	4570979	4725508	4878596	48
13	4260425	4417669	4573566	4728071	4881135	47
14	4263056	4420279	4576153	4730634	4883674	46
15	4265687	4422887	4578739	4733197	4886212	45
16	4268318	4425496	4581325	4735759	4888750	44
17	4270949	4428104	4583911	4738321	4891287	43
18	4273579	4430712	4586496	4740882	4893824	42
19	4276209	4433320	4589081	7434443	4896361	41
20	4278838	4435927	4591665	4746004	4898897	40
21	4281467	4438534	4594249	4748564	4901433	39
22	4284096	4441140	4596833	4751124	4903968	38
23	4286724	4443746	4599416	4753683	4906503	37
24	4289352	4446352	4601999	4756242	4909037	36
25	4291979	4448957	4604581	4758801	4911571	35
26	4294606	4451562	4607163	4761359	4914105	34
27	4297233	4454167	4609744	4763917	4916638	33
28	4299859	4456771	4612325	4766474	4919171	32
29	4302485	4459375	4614906	4769031	4921703	31
30	4305111	4461978	4617486	4771588	4924235	30
	64	63	62	61	60	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines

The minutes of degrees of the Quadrant for right Sines of the Arches of the ſame Quadrant.

	25	26	27	28	29	
30	4305111	4461978	4617486	4771588	4924235	30
31	4307736	4464581	4620066	4774144	4926767	29
32	4310361	4467184	4622646	4776700	4929298	28
33	4312986	4469786	4625225	4779255	4931829	27
34	4315610	4472388	4627804	4781810	4934359	26
35	4318234	4474990	4630382	4784365	4936889	25
36	4320858	4477591	4632960	4786919	4939418	24
37	4323481	4480192	4635538	4789473	4941947	23
38	4326104	4482792	4638115	4792026	4944476	22
39	4328726	4485392	4640692	4794579	4947004	21
40	4331348	4487992	4643268	4797132	4949532	20
41	4333970	4490591	4645844	4799684	4952059	19
42	4336591	4493190	4648420	4802236	4954586	18
43	4339212	4495788	4650995	4804787	4957113	17
44	4341833	4498380	4653570	4807338	4959639	16
45	4344453	4500984	4656145	4809888	4962165	15
46	4347073	4503582	4658719	4812438	4964690	14
47	4349693	4506179	4661293	4814988	4967215	13
48	4352312	4508776	4663866	4817537	4969740	12
49	4354931	4511372	4666439	4820086	4972264	11
50	4357549	4513968	4669012	4822635	4974788	10
51	4360167	4516563	4671584	4825183	4977311	9
52	4362785	4519158	4674156	4827731	4979834	8
53	4365402	4521753	4676727	4830278	4982356	7
54	4368019	4524347	4679298	4832825	4984878	6
55	4370635	4526941	4681869	4835371	4987399	5
56	4373251	4529535	4684439	4837917	4989920	4
57	4375867	4532128	4687009	4840462	4992441	3
58	4378482	4534721	4689578	4843007	4994961	2
59	4381097	4537313	4692147	4845552	4997481	1
60	4383712	4539905	4694716	4848096	5000000	0
	64	63	62	61	60	

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the ſame Quadran.

of the complements of the Arches of the ſame Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines.

The minutes of the degrees of the Quadrant for the right Sines of the same Quadrant.

	30	31	32	33	34	
0	5000000	5150381	5299192	5446390	5591929	60
1	5002519	5152874	5301659	5448829	5594340	59
2	5005038	5155367	5304125	5451268	5596751	58
3	5007556	5157859	5306591	5453707	5599161	57
4	5010074	5160351	5309056	5456145	5601571	56
5	5012591	5162843	5311521	5458585	5603981	55
6	5015108	5165334	5313985	5461020	5606390	54
7	5017624	5167825	5316449	5463456	5608798	53
8	5020140	5170315	5318913	5465892	5611206	52
9	5022656	5172805	5321376	5468328	5613614	51
10	5025171	5175294	5323839	5470763	5616021	50
11	5027686	5177783	5326301	5473198	5618427	49
12	5030200	5180271	5328763	5475632	5620833	48
13	5032714	5182759	5331224	5478066	5623239	47
14	5035227	5185246	5333685	5480499	5625644	46
15	5037740	5187733	5336145	5482932	5628049	45
16	5040253	5190220	5338605	5485364	5630453	44
17	5042765	5192706	5341065	5487796	5632857	43
18	5045277	5195192	5343524	5490228	5635260	42
19	5047788	5197677	5345983	5492659	5637663	41
20	5050299	5200162	5348441	5495096	5640066	40
21	5052809	5202646	5350899	5497520	5642468	39
22	5055319	5205130	5353355	5499950	5644869	38
23	5057829	5207614	5355812	5502379	5647270	37
24	5060338	5210097	5358268	5504808	5649670	36
25	5062847	5212580	5360724	5507236	5652070	35
26	5065355	5215062	5363179	5509664	5654469	34
27	5067863	5217544	5365634	5512091	5656868	33
28	5070370	5220025	5368088	5514518	5659266	32
29	5072877	5222506	5370542	5516944	5661664	31
30	5075384	5224986	5372996	5519370	5664062	30
	59	58	57	56	55	

The degrees of the Quadrant for the right Sines.

The minutes of degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant.

The Table of Sines.

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

	30	31	32	33	34	
0	5075384	5224986	5372996	5519370	5664062	30
1	5077890	5227466	5375449	5521795	5666459	29
2	5080396	5229949	5377902	5524220	5668856	28
3	5082901	5232425	5380354	5526645	5671252	27
4	5085406	5234904	5382806	5529069	5673648	26
5	5087911	5237382	5385258	5531493	5676043	25
6	5090415	5239860	5387709	5533916	5678438	24
7	5092619	5242337	5390159	5536338	5680832	23
8	5095422	5244814	5392609	5538760	5683226	22
9	5097925	5247290	5395058	5541182	5685619	21
10	5100427	5249766	5397507	5543603	5688012	20
11	5102929	5252241	5399955	5546024	5690404	19
12	5105430	5254716	5402403	5548444	5692796	18
13	5107931	5257191	5404851	5550864	5695187	17
14	5110431	5259665	5407298	5553283	5697578	16
15	5112931	5262139	5409745	5555702	5699968	15
16	5115431	5264612	5412191	5558110	5702358	14
17	5117930	5267085	5414637	5560538	5704747	13
18	5120429	5269557	5417082	5562956	5707136	12
19	5122927	5272029	5419527	5565373	5709524	11
20	5125425	5274501	5421972	5567790	5711912	10
21	5127922	5276972	5424416	5570206	5714299	9
22	5130419	5279443	5426859	5572622	5716686	8
23	5132916	5281913	5429302	5575037	5719072	7
24	5135412	5284383	5431747	5577452	5721458	6
25	5137908	5286852	5434187	5579866	5723844	5
26	5140403	5289321	5436620	5582280	5726229	4
27	5142898	5291789	5439070	5584693	5728613	3
28	5145393	5294257	5441510	5587106	5730997	2
29	5147887	5296725	5443950	5589518	5733381	1
30	5150381	5299192	5446390	5591929	4735764	0
	59	58	57	56	55	

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines.

	35	36	37	38	39	
0	5735764	5877852	6018150	6156615	6293204	60
1	5738147	5880205	6020470	6158907	6295464	59
2	5740529	5882558	6022796	6161198	6297724	58
3	5742911	5884910	6025118	6163489	6299983	57
4	5745292	5887262	6027439	6165780	6302242	56
5	5747672	5889613	6029760	6168070	6304501	55
6	5750052	5891964	6032080	6170359	6306759	54
7	5752432	5894315	6034400	6172648	6309016	53
8	5754811	5896664	6036719	6174936	6311273	52
9	5757190	5899013	6039038	6177224	6313529	51
10	5759568	5901361	6041357	6179512	6315784	50
11	5761946	5903709	6043675	6181799	6318039	49
12	5764323	5906056	6045992	6184085	6320293	48
13	5766700	5908403	6048309	6186371	6322547	47
14	5769076	5910750	6050625	6188656	6324800	46
15	5771452	5913096	6052940	6190940	6327053	45
16	5773827	5915442	6055255	6193224	6329305	44
17	5776201	5917787	6057570	6195508	6331557	43
18	5778576	5920132	6059884	6197791	6333808	42
19	5780950	5922476	6062198	6200074	6336059	41
20	5783324	5924820	6064511	6202356	6338310	40
21	5785697	5927165	6066824	6204638	6340560	39
22	5788069	5929505	6069136	6206919	6342809	38
23	5790441	5931847	6071448	6209199	6345058	37
24	5792812	5934189	6073752	6211479	6347306	36
25	5795183	5936530	6076069	6213758	6349553	35
26	5797553	5938871	6078379	6216037	6351800	34
27	5799923	5941211	6080688	6218315	6354046	33
28	5802292	5943551	6082997	6220593	6356292	32
29	5804661	5945890	6085306	6222870	6358537	31
30	5807030	5948228	6087614	6225146	6360782	30
	54	53	52	51	50	

The minutes of the degrees of the Quadrant for the right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines.

of the Arches of the same Quadrant.

	35	36	37	38	39	
30	5807030	5948228	6087614	6225146	6360782	30
31	5809398	5950566	6089922	6227422	6363026	29
32	5811766	5952904	6092229	6229698	6365270	28
33	5814133	5955241	6094536	6231973	6367513	27
34	5816499	5957578	6096842	6234248	6369756	26
35	5818865	5959914	6099147	6236522	6371999	25
36	5821230	5962250	6101452	6238796	6374241	24
37	5823595	5964585	6103756	6241069	6376482	23
38	5825959	5966919	6106060	6243342	6378722	22
39	5828323	5969253	6108364	6245614	6380962	21
40	5830687	5971586	6110667	6247885	6383210	20
41	5833050	5973919	6112970	6250156	6385440	19
42	5835412	5976251	6115272	6252426	6387678	18
43	5837774	5978583	6117573	6254696	6389916	17
44	5840136	5980915	6119873	6256966	6392153	16
45	5842497	5983146	6122173	6259235	6394390	15
46	5844858	5985577	6124473	6261503	6396626	14
47	5847218	5987907	6126772	6263771	6398862	13
48	5849578	5990237	6129071	6266038	6401097	12
49	5851937	5992566	6131369	6268305	6403333	11
50	5854295	5994894	6133667	6270572	6405566	10
51	5856653	5997222	6135964	6272838	6407799	9
52	5859010	5999549	6138261	6275103	6410032	8
53	5861367	6001876	6140557	6277368	6412264	7
54	5863724	6004202	6142853	6279632	6414496	6
55	5866080	6006528	6145148	6281895	6416728	5
56	5868436	6008853	6147442	6284158	6418959	4
57	5870791	6011178	6149736	6286420	6421189	3
58	5873145	6013502	6152030	6288682	6423419	2
59	5875499	6015826	6154325	6290943	6425648	1
60	5877852	6018150	6156615	6293204	6427876	0
	54	53	52	51	50	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant

The Table of Sines.

The degrees of the Quadrant for the right Sines

	40	41	42	43	44	
1 0	6427876	6560590	6691306	6819984	6946584	60
1	6430104	6562785	6693468	6822111	6948676	59
2	6432331	6564979	6695629	6824237	6950767	58
3	6434558	6567173	6697789	6826363	6952858	57
4	6436785	6569367	6699949	6828489	6954949	56
5	6439011	6571560	6702108	6830614	6957039	55
6	6441236	6573753	6704267	6832738	6959128	54
7	6443461	6575945	6706425	6834861	6961216	53
8	6445685	6578136	6708582	6836984	6963304	52
9	6447909	6580326	6710739	6839107	6965392	51
10	6450132	6582516	6712895	6841229	6967479	50
11	6452355	6584705	6715051	6843350	6969565	49
12	6454577	6586894	6717206	6845471	6971651	48
13	6456799	6589082	6719361	6847591	6973736	47
14	6459020	6591270	6721515	6849711	6975821	46
15	6461240	6593458	6723968	6851830	6977905	45
16	6463460	6595645	6725821	6853949	6979988	44
17	6465679	6597831	6727973	6856067	6982071	43
18	6467898	6600016	6730125	6858184	6984153	42
19	6470116	6602201	6732276	6860301	6986235	41
20	6472333	6604386	6734427	6862417	6988319	40
21	6474550	6606570	6736577	6864533	6990396	39
22	6476766	6608753	6738726	6866648	6962476	38
23	6478982	6610936	6740875	6868762	6994555	37
24	6481198	6613118	6743024	6870870	6996634	36
25	6483413	6615300	6745172	6872989	6998712	35
26	6485628	6617481	6747319	6875102	7000789	34
27	6487842	6619661	6749465	6877214	7002866	33
28	6490055	6621841	6751611	6876325	7004942	32
29	6492268	6624021	6753757	6881436	7007018	31
30	6494480	6626200	6755902	6883546	7009093	30
	49	48	47	46	45	

The degrees of the Quadrant for the right Sines.

The minutes of the degrees of the Quadrant for the right Sines of the Arches of the same Quadrant

The minutes of degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant

The Table of Sines of the Arches of the same Quadrant

	40	41	42	43	44	
30	6494480	6626200	6755902	6883546	7009093	30
31	6496692	6628379	6758047	6885656	7011167	29
32	6498903	6630557	6760191	6887765	7013241	28
33	6501114	6632734	6762334	6889874	7015314	27
34	6503324	6634911	6764477	6891982	7017387	26
35	6505533	6637087	6766619	6894089	7019459	25
36	6507742	6639263	6768760	6896196	7021530	24
37	6509950	6641438	6770901	6898302	7023601	23
38	6512158	6643612	6773041	6900804	7025671	22
39	6514365	6645786	6775181	6902513	7027741	21
40	6516572	6647959	6777320	6904617	7029810	20
41	6518778	6650132	6779459	6906721	7031879	19
42	6520984	6652304	6781597	6908824	7033947	18
43	6523189	6654476	6783734	6910927	7036014	17
44	6525394	6656647	6785871	6913029	7038081	16
45	6527598	6658817	6788007	6915131	7040147	15
46	6529801	6660987	6790143	6917232	7042213	14
47	6532004	6663156	6792278	6919332	7044278	13
48	6534206	6665325	6794413	6921432	7046342	12
49	6536408	6667493	6796547	6923531	7048406	11
50	6538609	6669661	6798681	6925563	7050469	10
51	6540809	6671828	6800814	6927728	7052432	9
52	6543009	6673994	6802946	6929725	7054594	8
53	6545208	6676160	6805078	6931922	7056655	7
54	6547407	6678326	6807209	9934018	7058716	6
55	6549606	6680491	6809340	6936114	7060776	5
56	6551804	6682655	6811470	6938209	7062836	4
57	6554001	6684818	6813599	6940303	7064895	3
58	6556198	6686981	6815728	6942397	7066953	2
59	6558394	6689144	6817856	6944491	7069011	1
60	6560590	6691306	6819984	6946584	7071068	0
	49	48	48	46	45	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines

The minutes of the degrees of the Quadrant for the right Sines of the Arches of the same Quadrant.

	45	46	47	48	49	
0	7071068	7193398	7313537	7431448	7547096	60
1	7073125	7195418	7315521	7433394	7549004	59
2	7075181	7197438	7317504	7435339	7550911	58
3	7077236	7199457	7319486	7437284	7552818	57
4	7079291	7201476	7321468	7439229	7554724	56
5	7081345	7203494	7323449	7441173	7556630	55
6	7083399	7205511	7325429	7443116	7558535	54
7	7085452	7207527	7327409	7445058	7560439	53
8	7087504	7209543	7329388	7447000	7562343	52
9	7089556	7211559	7331367	7448941	7564246	51
10	7091607	7213574	7333345	7450882	7566148	50
11	7093658	7215588	7335322	7452812	7568050	49
12	7095708	7217601	7337298	7454761	7569951	48
13	7097757	7219614	7339274	7456690	7518751	47
14	7099800	7221627	7341250	7458637	7573751	46
15	9101854	7223639	7343225	7460574	7575650	45
16	7103902	7225661	7345199	7462511	7577548	44
17	7105949	7227662	7347173	7464447	7579446	43
18	7107995	7229672	7349146	7466382	7581343	42
19	7110041	7231681	7351118	7468317	7583240	41
20	7112086	7233689	7353090	7470251	7585136	40
21	7114131	7235697	7355061	7472184	7587031	39
22	7116175	7237704	7357031	7474117	7588925	38
23	7118218	7239711	7359001	7476049	7590819	37
24	7120261	7241718	7360970	7477981	7592714	36
25	7122303	7243724	7362939	7479912	7594606	35
26	7124344	7245729	7364907	7481842	7596498	34
27	7126385	7247733	7366874	7483771	7598389	33
28	7128245	7249737	7368841	7485700	7600280	32
29	7130465	7251741	7370807	7487629	7602170	31
30	7132504	7253744	7372773	7489555	7604060	30
	44	42	43	41	40	

The degrees of the Quadrant for the Sines.

The minutes of degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant

	45	46	47	48	49	
30	7132504	7253744	7372773	7489557	7604060	30
31	7134543	7255746	7374738	7491484	7605949	29
32	7136581	7257747	7376702	7493410	7607637	28
33	7138618	7259748	7378666	7495336	7609725	27
34	7140655	7261749	7380926	7497262	7611612	26
35	7142691	7263759	7382592	7499187	7613498	25
36	7144724	7265748	7384554	7501111	7615384	24
37	7146762	7267746	7386515	7503034	7617269	23
38	7148796	7269744	7388475	7504957	7619153	22
39	7150830	7271741	7390435	7506879	7621037	21
40	7152863	7273737	7392394	7508801	7622920	20
41	7154895	7275733	7394353	7510722	7624802	19
42	7156927	7277728	7396311	7512642	7626683	18
43	7158958	7279722	7398268	7514561	7628564	17
44	7160989	7281716	7400225	7516480	7630445	16
45	7163019	7283710	7402181	7518398	7632325	15
46	7165049	7285703	7404137	7520316	7634204	14
47	7167078	7287695	7406092	7522233	7636082	13
48	7169106	7289687	7408046	7524149	7637960	12
49	7171134	7291678	7410000	7526065	7639838	11
50	7173161	7293668	7411953	7527980	7641715	10
51	7175187	7295658	7413905	7529894	7643591	9
52	7177123	7297647	7415856	7531808	7645466	8
53	7179238	7299635	7417807	7533721	7647341	7
54	7181263	7301623	7419758	7535634	7649215	6
55	7183287	7303610	7421708	7537546	7651088	5
56	7185310	7305597	7423657	7539457	7652961	4
57	7187333	7307583	7425605	7541367	7654833	3
58	7189355	7309568	7427552	7543277	7656704	2
59	7191377	7311553	7429501	7545187	7658575	1
60	7193398	7313537	7431448	7547096	7660445	0
	44	43	42	41	40	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the ſame Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant.

The Table of Sines,

The degrees of the Quadrant for the right Sines

	45	46	47	48	49	
0	7071068	7193398	7313537	7431448	7547096	60
1	7073125	7195418	7315521	7433394	7549004	59
2	7075181	7197438	7317504	7435339	7550911	58
3	7077236	7199457	7319486	7437284	7552818	57
4	7079291	7201476	7321468	7439229	7554724	56
5	7081345	7203494	7323449	7441173	7556630	55
6	7083399	7205511	7325429	7443116	7558535	54
7	7085452	7207527	7327409	7445058	7560439	53
8	7087504	7209543	7329388	7447000	7562343	52
9	7089556	7211559	7331367	7448941	7564246	51
10	7091607	7213574	7333345	7450882	7566148	50
11	7093658	7215588	7335322	7452822	7568050	49
12	7095708	7217601	7337298	7454761	7569951	48
13	7097757	7219614	7339274	7456690	7518751	47
14	7099800	7221627	7341250	7458637	7573751	46
15	9101854	7223639	7343225	7460574	7575650	45
16	7103902	7225661	7345199	7462511	7577548	44
17	7105949	7227662	7347173	7464447	7579446	43
18	7107995	7229672	7349146	7466382	7581343	42
19	7110041	7231681	7351118	7468317	7583240	41
20	7112086	7233689	7353090	7470251	7585136	40
21	7114131	7235697	7355061	7472184	7587031	39
22	7116175	7237704	7357031	7474117	7588925	38
23	7118218	7239711	7359001	7476049	7590819	37
24	7120261	7241718	7360970	7477981	7592714	36
25	7122303	7243724	7362939	7479912	7594606	35
26	7124344	7245729	7364907	7481842	7596498	34
27	7126385	7247733	7366874	7483771	7598389	33
28	7128245	7249737	7368841	7485700	7600280	32
29	7130465	7251741	7370807	7487629	7602170	31
30	7132504	7253744	7372773	7489575	7604060	30
	44	42	43	41	40	

The degrees of the Quadrant for the Sines.

The minutes of the degrees of the Quadrant for the right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant.

	45	46	47	48	49	
30	7132504	7253744	7372773	7489557	7604060	30
31	7134543	7255746	7374738	7491484	7605949	29
32	7136581	7257747	7376702	7493410	7607637	28
33	7138618	7259748	7378666	7495336	7609725	27
34	7140655	7261749	7380926	7497262	7611612	26
35	7142691	7263759	7382592	7499187	7613498	25
36	7144724	7265748	7384554	7501111	7615384	24
37	7146762	7267746	7386515	7503034	7617269	23
38	7148796	7269744	7388475	7504957	7619153	22
39	7150830	7271741	7390435	7506879	7621037	21
40	7152863	7273737	7392394	7508801	7622920	20
41	7154895	7275733	7394353	7510722	7624802	19
42	7156927	7277728	7396311	7512642	7626683	18
43	7158958	7279722	7398268	7514561	7628564	17
44	7160989	7281716	7400225	7516480	7630445	16
45	7163019	7283710	7402181	7518398	7632325	15
46	7165049	7285703	7404137	7520316	7634204	14
47	7167078	7287695	7406092	7522233	7636082	13
48	7169106	7289687	7408046	7524149	7637960	12
49	7171134	7291678	7410000	7526065	7639838	11
50	7173161	7293668	7411953	7527980	7641715	10
51	7175187	7295658	7413905	7529894	7643591	9
52	7177123	7297647	7415856	7531808	7645466	8
53	7179238	7299635	7417807	7533721	7647341	7
54	7181263	7301623	7419758	7535634	7649215	6
55	7183287	7303610	7421708	7537546	7651088	5
56	7185310	7305597	7423657	7539457	7652961	4
57	7187333	7307583	7425605	7541367	7654833	3
58	7189355	7309568	7427552	7543277	7656704	2
59	7191377	7311553	7429501	7545187	7658575	1
60	7193398	7313537	7431448	7547096	7660445	0
	44	43	42	41	40	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the ſame Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

	50	51	52	53	54	
0	7660445	7771460	7880108	7986355	8090170	60
1	7662314	7773290	7881898	7988105	8091869	59
2	7664183	7775120	7883688	7989855	8093588	58
3	7666051	7776949	7885477	7991604	8095296	57
4	7667919	7778777	7887266	7993352	8097004	56
5	7669786	7780605	7889054	7995100	8098711	55
6	7671652	7782432	7890841	7996847	8100417	54
7	7673517	7784258	7892927	7998593	8102122	53
8	7675382	7786084	7894413	8000339	8103827	52
9	7677246	7787909	7896198	8002084	8105531	51
10	7679110	7789833	7897983	8003828	8107234	50
11	7680973	7791557	7899767	8005571	8108936	49
12	7682835	7793380	7901550	8007314	8110638	48
13	7684697	7795202	7903332	8009056	8112339	47
14	7686558	7797024	7905114	8010797	8114040	46
15	7688418	7798845	7906895	8012538	8115740	45
16	7690278	7800665	7908676	8014278	8117439	44
17	7692137	7802485	7910456	8016017	8119137	43
18	7693995	7804304	7912235	8017756	8120835	42
19	7695853	7806123	7914014	8019494	8122532	41
20	7697710	7807941	7915792	8021232	8124229	40
21	7699566	7809758	7917569	8022969	8125925	39
22	7701422	7811574	7919345	8024705	8127620	38
23	7703277	7813390	7921121	8026440	8129314	37
24	7705132	7815205	7922896	8028175	8131008	36
25	7706986	7817020	7924671	8029909	8132701	35
26	7708839	7818834	7926445	8021642	8134393	34
27	7710692	7820647	7928218	8033375	8136084	33
28	7712544	7822459	7929990	8035107	8137775	32
29	7714395	7824271	7931762	8036838	8139465	31
30	7716246	7826082	7933533	8038569	8141155	30
	39	38	37	36	35	

The minutes of degrees of the Quadrant or right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines

The minutes of degrees of the Quadrant for the right Sines of the Arches of the ſame Quadrant.

	50	51	52	53	54	
30	7716246	7826082	7933533	8038569	8141155	30
31	7718096	7827892	7935303	8040299	8142844	29
32	7719945	7829702	7937073	8042028	8144532	28
33	7721794	7831511	7938842	8043757	8146220	27
34	7723642	7833320	7940611	8045485	8147907	26
35	7725490	8835128	7942379	8047212	8149593	25
36	7727337	7836935	7944146	8048938	8151278	24
37	7729183	7838741	7945912	8050664	8152963	23
38	7731028	7840547	7947678	8052389	8154647	22
39	7732872	7842352	7949443	8054114	8156330	21
40	7734716	7844157	7951208	8055838	8158013	20
41	7736559	7845961	7952972	8057561	8159695	19
42	7738402	7847764	7954735	8059283	8161376	18
43	7740244	7849566	7956497	8061005	8163057	17
44	7742085	7851368	7958259	8062726	8164737	16
45	7743926	7853169	7960020	8046446	8166416	15
46	7745766	7854970	7961780	8066166	8168094	14
47	7747606	7856770	7963540	8067885	8169772	13
48	7749445	7858569	7965299	8069603	8171449	12
49	7751283	7800368	7967057	8071321	8173126	11
50	7753121	7862166	7968815	8073038	8174802	10
51	7754958	7863963	7970572	8074754	8176477	9
52	7756794	7865759	7972328	8076470	8178151	8
53	7758630	7867555	7974084	8078185	8179825	7
54	7760465	7869350	7975839	8079899	8181498	6
55	7762299	7871145	7977593	8081613	8183170	5
56	7764132	7872939	7979347	8083326	8184841	4
57	7765965	7874732	7981100	8085038	8186512	3
58	7767797	7876525	7982852	8086749	8188182	2
59	7769609	7878317	7984604	8088460	8189851	1
60	7771460	7880108	7986355	8060170	8191520	0
	39	38	37	36	35	

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the ſame Quadrant,

of the complements of the Arches of the ſame Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines

	55	56	57	58	59	
0	8191520	8270376	8386706	8480481	8571673	60
1	8193188	8292002	8388290	8482022	8573171	59
2	8194855	8293628	8389873	8483562	8574668	58
3	8196522	8295253	8391456	8485102	8576164	57
4	8198188	8296877	8393038	8486641	8577660	56
5	8199854	8298501	8394619	8488180	8579155	55
6	8201519	8300124	8396199	8489718	8580649	54
7	8203183	8301746	8397778	8491255	8582142	53
8	8204846	8303367	8399357	8492791	8583635	52
9	8206508	8304987	8400935	8494326	8585127	51
10	8208170	8306607	8402513	8495860	8586619	50
11	8209831	8308226	8404090	8497394	8588110	49
12	8211491	8309844	8405666	8498927	8589600	48
13	8218151	8311462	8407241	8500459	8591089	47
14	8214810	8313079	8408816	8501991	8592577	46
15	8216469	8314696	8410390	8503522	8594064	45
16	8218127	8316312	8411963	8505052	8595551	44
17	8219784	8317927	8413536	8506582	8597037	43
18	8221440	8319541	8415108	8508111	8598523	42
19	8223096	8321155	8416679	8509639	8600008	41
20	8224751	8322768	8418250	8511167	8601492	40
21	8226405	8324380	8419820	8512694	8602975	39
22	8228058	8325991	8421389	8514220	8604457	38
23	8229711	8327602	8422957	8515745	8605939	37
24	8231363	8329212	8424525	8517270	8607420	36
25	8233015	8330822	8426092	8518794	8608901	35
26	8234666	8332431	8427658	8520317	8610381	34
27	8236316	8334039	8429223	8521839	8611860	33
28	8237965	8335646	8430788	8523361	8613338	32
29	8239614	8337252	8432352	8524882	8614815	31
30	8241262	8338858	8433915	8526402	8616292	30
	34	33	32	31	30	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

	55	56	57	58	59	
30	8241262	8338858	8433915	8526402	8616292	30
31	8251909	8340463	8435477	8527921	8617768	29
32	8244556	8342067	8437039	8529440	8619243	28
33	8246202	8343671	8438600	8530958	8620718	27
34	8247847	8345247	8440161	8532476	8622192	26
35	8249492	8346877	8441721	8533993	8623665	25
36	8251136	8348479	8443280	8535509	8625137	24
37	2528779	8350080	8444838	8537024	8626608	23
38	8254421	8351680	8446396	8538538	8628079	22
39	8256062	8353279	8447953	8540052	8629549	21
40	8257703	8354878	8449509	8541565	8631019	10
41	8259343	8356476	8451064	8543077	8632488	19
42	8260982	8358073	8452618	8544588	8633986	18
43	8262621	8359670	8454172	8549599	8635423	17
44	8264259	8361266	8455725	8547609	8636859	16
45	8265897	8362862	8457278	8549119	8638355	15
46	8267534	8364457	84588 30	8550628	8639820	14
47	8269170	8366051	8460381	8552136	8641284	13
48	8270806	8367644	8461932	8553643	8642748	12
49	8272441	8369236	8463482	8555149	8644211	11
50	8274075	8370828	8465031	8556655	8645673	10
51	8275708	8372419	8466579	8558160	8547134	9
52	8277340	8374009	8468126	8559664	8648595	8
53	8278972	8365599	8469673	8561168	8650055	7
54	8280603	8377188	8471219	8562671	8651514	6
55	8282234	8378776	8472765	8564173	8652973	5
56	8283864	8380363	8474310	8565675	8654431	4
57	8285493	8381950	8475854	8567176	8655888	3
58	8287121	8383536	8477397	8568676	8657344	2
59	8288749	8385121	8478939	8570175	8658799	1
60	8290376	8386706	8480481	8571673	8660254	0
	34	33	32	31	30	

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines.

	60	61	62	63	64	
0	8660254	8746197	8829476	8910065	8987940	60
1	8661708	8747607	8830841	8911385	8989215	59
2	8663162	8749016	8832205	8912704	8990489	58
3	8664615	8750425	8833569	8914023	8991762	57
4	8666067	8751833	8834932	8915341	8993035	56
5	8667517	8753240	8836295	8916659	8994307	55
6	8668968	8754646	8837657	8917976	8995578	54
7	8670417	8756051	8839018	8919292	8996848	53
8	8671866	8757456	8840378	8920607	8998117	52
9	8673314	8758860	8841737	8921921	8999386	51
10	8674762	8760263	8843095	8923234	9000654	50
11	8676209	8761665	8844452	8924546	9001921	49
12	8677655	8763067	8845809	8925858	9003187	48
13	8679100	8764468	8847165	8927169	9004453	47
14	8680544	8765868	8848521	8928479	9005718	46
15	8681988	8767268	8849876	8929789	9006982	45
16	8683431	8768667	8851230	8931098	9008245	44
17	8684874	8770065	8852583	8932406	9009508	43
18	8686316	8771462	8853936	8933714	9010770	42
19	8687757	8772859	8855288	8935021	9012031	41
20	8689197	8774255	8856639	8936327	9013292	40
21	8699636	8775650	8857989	8937632	9014552	39
22	8692074	8777044	8859338	8938936	9015811	38
23	8693512	8778437	8860687	8940240	9017069	37
24	8694949	8779830	8862035	8941543	9018326	36
25	8696386	8781222	8863383	8942845	9019582	35
26	8697822	8782613	8864730	8944146	9020838	34
27	8699257	8784003	8866076	8945446	9022093	33
28	8700691	8785393	8867421	8946746	9023347	32
29	8702124	8786782	8868765	8948045	9024600	31
30	8703557	8788171	8870108	8949344	9025853	30
	29	28	27	26	25	

The minutes of the degrees of the Quadrant for the right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines.

of the Arches of the same Quadrant.

	60	61	62	63	64	
30	8703557	8788171	8870108	8949344	9025853	30
31	8704989	8789559	8871451	8950642	9027105	29
32	8706420	8790946	8872793	8951939	9028356	28
33	8707851	8792332	8874134	8953235	9029606	27
34	8709281	8793717	8875475	8954530	9030856	26
35	8710710	8795102	8876815	8955824	9032105	25
36	8712138	8796486	8878154	8957117	9033353	24
37	8713565	8797869	8879492	8958410	9034600	23
38	8714992	8799251	8880830	8959702	9035847	22
39	8716418	8800633	8882167	8960994	9037093	21
40	8717844	8802014	8883503	8962285	9038338	20
41	8719269	8803394	8884838	8963575	9039582	19
42	8720693	8804773	8886172	8964864	9040825	18
43	8722116	8806152	8887506	8966152	9042068	17
44	8723538	8807530	8888839	8967440	9043310	16
45	8724960	8808907	8890171	8968727	9044551	15
46	8726381	8810283	8891502	8970013	9045791	14
47	8727801	8811659	8892833	8971299	9047031	13
48	8729221	8813034	8894163	8972584	9048270	12
49	8730640	8814408	8895492	8973868	9049508	11
50	8732058	8815782	8896821	8975151	9050746	10
51	8733475	8817155	8898149	8976433	9051983	9
52	8734891	8818527	8899476	8977715	9053219	8
53	8736307	8819898	8900802	8978996	9054454	7
54	8737722	8821268	8902127	8980276	9055688	6
55	8739137	8822638	8903452	8981555	9056922	5
56	8740551	8824007	8904776	8982833	9058155	4
57	8741964	8825375	8906099	8984111	9059387	3
58	8743376	8826743	8907422	8985388	9060618	2
59	8744787	8828110	8908744	8986664	9061848	1
60	8746197	8829476	8910065	8987940	9063078	0
	25	26	27	28	29	

The minutes of the degrees on the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines.

	65	66	67	68	69	
0	9063078	9135455	9205049	9271839	9335804	60
1	9064307	9136638	9206185	9272928	9336846	59
2	9065535	9137820	9207321	9274017	9337887	58
3	9066763	9139001	9208456	9275105	9338928	57
4	9067990	9140181	9209590	9276192	9339968	56
5	9069216	9141361	9210723	9277278	9341007	55
6	9070441	9142540	9211855	9278363	9342045	54
7	9071665	9143718	9212986	9279448	9343082	53
8	9072889	9144895	9214117	9280532	9344119	52
9	9074112	9146072	9215247	9281615	9345155	51
10	9075334	9147248	9216376	9282697	9346190	50
11	9076555	9148423	9217504	9283778	98472 24	49
12	9077775	9149597	9218631	9284859	9341257	48
13	9078995	9150770	9219758	9285939	9349289	47
14	9080214	9151943	9220884	9287018	9350321	46
15	9081432	9153115	9222010	9288096	9351352	45
16	9082649	9154286	9223135	9289173	9352382	44
17	6083866	9155457	9224259	9290250	6353411	43
18	9085082	9156627	9225385	9291326	9354440	42
19	9086297	9157796	9226504	9292401	9355468	41
20	9087512	9158964	9227625	9293476	9356495	40
21	9088726	9160131	9228746	9294550	9357521	39
22	9089939	9161297	9229866	9295623	9358546	38
23	9091151	9162463	9230985	9296695	9359571	37
24	9092362	9163628	9232103	9297766	6360595	36
25	9093572	9165792	9233220	9298836	9361618	35
26	9094781	9165955	9234337	9299905	9362640	34
27	9095990	9167117	9235453	9300974	9363662	33
28	9097198	9168279	9236568	9302042	9364683	32
29	9098406	9169440	9237682	9303109	9365703	31
30	9099613	9170601	9238795	9304176	9366722	30
	24	23	22	21	20	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadran for right Sines.

of the Arches of the same Quadrant.

	65	66	67	98	69	
1						
30	9099613	9170601	9238795	9304176	9300722	30
31	9100819	9171761	9239908	9305242	9367740	29
32	9102024	9172910	9241020	9306307	9368758	28
33	9103228	9174078	9242131	9307371	9369775	27
34	9104432	9175231	9243242	9308434	9370791	26
35	9105636	9176393	9244352	9309497	9371806	25
36	9106837	9177547	9245461	6310559	9372820	24
37	9108038	9178702	9246569	9311620	9373834	23
38	9109238	9179856	9247676	9312680	9374847	22
39	9110438	9181009	9248782	9313739	9375859	21
40	9111637	9182161	9249888	9314798	9376870	20
41	9112835	9183313	9250993	9315856	9377880	19
42	9114032	9184464	9252097	9316913	9378889	18
43	9115229	9185614	9253200	9317969	9379898	17
44	9116425	9186763	9254303	9319024	9380906	16
45	9117620	9187912	9255405	6320079	9381913	15
46	9118814	9189060	9256506	9321133	9382919	14
47	9120007	9160207	9257606	9322186	9383925	13
48	9121200	9191353	9258706	9323238	9384930	12
49	9122392	9192499	9259805	9324290	9385934	11
50	9123584	9193644	9260963	9325241	9386937	10
51	9124775	9194788	9262000	9326391	9387939	9
52	9125965	9195931	9263096	9327440	9388941	8
53	9127154	9197073	9264192	9328488	9389942	7
54	9128342	9198215	9265287	9329535	9390942	6
55	9129529	9199356	9266381	9330582	9391941	5
56	9130716	9200496	9267474	9331628	9392940	4
57	9131902	9201635	9268566	9332673	9393938	3
58	6133087	9202774	9269658	6333717	9394935	2
59	9134271	9203912	9270749	9334761	9395931	1
60	9135455	9205049	9271839	9335804	9396926	0
	24	23	22	21	20	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Sines.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

	70	71	72	73	74	
0	9396926	9455186	9510565	9563048	9612617	60
1	9397921	9456133	9511464	9563898	9613418	59
2	9398915	9457079	9512362	9564747	9614219	58
3	9399908	9458024	9513259	9565596	9615019	57
4	9400900	9458968	9514155	9566444	9615818	56
5	9401891	9459911	9515050	9567291	9616616	55
6	9402882	9460854	9515944	9568137	9617413	54
7	9403872	9461796	9516838	9568982	9618209	53
8	9404861	9462737	9517731	9569826	9619005	52
9	9405849	9463677	9518623	9570670	9619800	51
10	9406836	9464616	9519514	9571513	9620594	50
11	9407822	9465555	9520404	9572355	9621387	49
12	9408808	9466493	9521294	9573196	9622179	48
13	9409793	9467430	9522183	9574036	9622971	47
14	9410777	9468366	9523071	9574875	9623762	46
15	9411760	9469301	9523958	9575714	9624552	45
16	9412742	9470236	9524844	9576552	9625341	44
17	9413724	9471170	9525730	9577389	9626129	43
18	9414705	9472103	9526615	9578225	9626917	42
19	9415685	9473035	9527499	9579061	9627704	41
20	9416665	9473967	9528382	9579896	9628490	40
21	9417644	9474898	9529264	9580730	9629275	39
22	9418622	9475828	9530146	9581563	9630059	38
23	9419599	9476757	9531027	9582395	9630843	37
24	9420575	9477685	9531907	9583226	9631626	36
25	9421550	9478612	9532786	9584057	9632408	35
26	9422525	9479539	9533664	9584887	9633189	34
27	9423499	9480465	9534541	9585716	9633969	33
28	9425472	9481390	9535418	9586544	9634748	32
29	9425444	9482314	9536294	9587371	9635527	31
30	9426594	9483237	9537169	9588197	9636305	30
	19	18	17	16	15	

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for right Sines.

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

	70	71	72	73	74	
30	9426415	9483237	9537169	9588197	9636305	30
31	9427386	9484160	9538043	9589023	9637082	29
32	9428356	9485082	9538917	9589848	9637858	28
33	9429325	9486003	9539790	9590672	9638633	27
34	9430293	9486923	9540662	9591495	9639408	26
35	9431260	9487842	9541533	9592318	9640182	25
36	9432227	9488761	9542403	9593140	9640955	24
37	9433193	9489679	9543272	9593961	9641727	23
38	9434158	9490596	9544141	9594781	9642498	22
39	9435122	9491512	9545009	9595600	9643268	21
40	9436085	9492427	9545876	9596419	9644038	20
41	9437048	9493341	9546742	9597237	9644807	19
42	9438010	9494255	9547607	9598054	9645575	18
43	9438971	9495168	9548472	9598870	9646342	17
44	9439931	9496080	9549336	9599685	9647108	16
45	9440890	9496991	9550199	9600499	9647873	15
46	9441849	9497902	9551061	9601313	9648638	14
47	9442807	9498812	9551922	9602126	9649402	13
48	9443764	9499721	9552783	9602938	9650165	12
49	9444720	9500629	9553643	9603749	9650927	11
50	9445676	9501536	9554502	9604559	9651689	10
51	9446631	9502443	9555360	9605368	9652450	9
52	9447585	9503349	9556217	9606177	9653210	8
53	9448538	9504254	9557074	9606985	9653969	7
54	9449490	9505158	9557930	9607792	9654727	6
55	9450441	9506061	9558785	9608598	9655484	5
56	9451392	9506963	9559639	9609403	9656240	4
57	9452342	9507865	9560492	9610208	9656996	3
58	9453291	9508766	9561345	9611012	9657751	2
59	9454239	9509666	9562197	9611815	9658505	1
60	9455186	9510565	9563048	9612617	9659258	0
	19	18	17	16	15	

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines.

The minutes of the degrees of the Quadrant for the right Sines of the Arches of the same Quadrant.

	75	76	77	78	79	
0	9659258	9702957	9743600	9781476	9816272	60
1	9660011	9703660	9744355	9782080	9816827	59
2	9660163	9704363	9745008	9782684	9817381	58
3	9661514	9705065	9745660	9783281	9817934	57
4	9662264	9705766	9749312	9783889	9818486	56
5	9663013	9706466	9746963	9784490	9819037	55
6	9663761	9701659	9747013	9785090	9819587	54
7	9664508	9707863	6748262	9785689	9820137	53
8	9665255	9708561	9748910	9786288	9820686	52
9	9666001	9709258	9749557	9786886	9821234	51
10	9666746	9709954	9750203	9787483	9821781	50
11	9667490	9710649	9750849	9788079	9822327	49
12	9668233	9711343	9751494	9788674	9822872	48
13	9668976	9712036	9752138	9789268	9823417	47
14	9669718	9712729	9752781	9789862	9823961	46
15	9670459	9713421	9753424	9790455	9824504	45
16	9671199	9714112	9754065	9791047	9825046	44
17	9671938	9714802	9754706	9791938	9825587	43
18	9672677	9715491	9755346	9792228	9826128	42
19	9673415	9716180	9755985	9792818	9826668	41
20	9674152	9716868	9756623	9793407	9827207	40
21	9674888	9717555	9757260	9793995	9822443	39
22	9675623	9718241	9757897	9794582	9828282	38
23	9676357	9718926	9758533	9795168	9828818	37
24	9677091	9719610	9759168	9795753	9826354	36
25	9677824	9720294	9759802	9796337	9829889	35
26	9678556	9720977	9760435	9796921	9830423	34
27	9679287	9721659	9761067	9797504	9830956	33
28	9680017	9722340	9761699	9798086	9831488	32
29	9680747	9723020	9762330	9768667	9832069	31
30	9681476	9723699	9762960	9799247	9832549	30
	14	13	12	11	10	

The minutes of degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines.

The Table of Sines.

of the Arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the Arches of the ſame Quadrant.

	75	76	77	78	79	
30	9681476	9723699	9762960	9799247	9832549	30
31	9682805	9724378	9763589	9799827	9833079	29
32	9682931	9725056	9764217	9800406	9833608	28
33	9683657	9725733	9764843	9800984	9834136	27
34	9684383	9726409	9765472	6801561	9834663	26
35	9685108	9727085	9766098	9802137	9835189	25
36	9685832	9727760	9766723	9802712	9835714	24
37	9686555	9728434	9767347	9803287	9836239	23
38	6687277	9729197	9767970	9803861	9836763	22
39	9687998	9729779	9768593	9804434	9837286	21
40	9688719	9730450	9769215	9805 006	9837808	20
41	9689439	9731120	9769836	9805577	9838329	19
42	9690158	9731789	9770456	9806147	9838850	18
43	9690879	9732458	9771075	9806716	9839370	17
44	9691593	9733126	9771693	9807285	9839889	16
45	9692309	9733793	9772311	9807853	9840407	15
46	9693025	9734459	9772928	9808420	9840924	14
47	9693740	9735124	9773544	9808986	9841440	13
48	9694454	9735789	9775 159	9809551	9841959	12
49	9695167	9736453	9774773	9810116	9842471	11
50	9695879	9737116	9775387	9810680	9842985	10
51	9696590	9737778	9776000	9811243	9843498	9
52	9697301	9738439	9776612	9811805	9844010	8
53	9698011	9739099	9777223	9812366	9844521	7
54	9690720	9739759	9777833	9812926	9845032	6
55	9699428	9740418	9778442	9813486	9845542	5
56	9700135	9741076	9779050	9814045	9846051	4
57	9700842	9741733	9779658	9814603	9846559	3
58	9701542	9742389	9780265	9815160	9849066	2
59	9702253	9743045	9780871	9815716	9847572	1
60	9702957	9743700	9781476	9816271	9848078	0
	14	13	12	11	10	

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines.

	80	81	82	83	84	
0	9848078	9876883	9902681	9925461	9945219	60
1	9848583	9877338	9903085	9925816	9945523	59
2	9849087	9877792	9903489	9926169	9945826	58
3	9849590	9878245	9903892	9926521	9946128	57
4	9850093	9878697	9904294	9926873	9946429	56
5	9850593	9879148	9904695	9927224	9946729	55
6	9851093	9879598	9905095	9927574	9947028	54
7	9851593	9880048	9905494	9927923	9947337	53
8	9852092	9880497	9905893	9928271	9947625	52
9	9852590	9880945	9906291	9528618	9947622	51
10	9853087	9881392	9906688	9928965	9948218	50
11	9853583	9881838	9907084	9929311	9948513	49
12	9854079	9882283	9907479	9929656	9948807	48
13	9854574	9882728	9907873	9930000	9949100	47
14	9855068	9883172	9908266	9930343	9949393	46
15	9855561	9883615	9908659	9930685	9949685	45
16	9856053	9884057	9909051	9931026	9949976	44
17	9856544	9884498	9909442	9931367	9950266	43
18	9857035	9884938	9909832	9931707	9950555	42
19	9857525	9885378	9910221	9932046	9950844	41
20	9858014	9885817	9910610	9932384	9951132	40
21	9858502	9886255	9910998	9932721	9951419	39
22	9858989	9886692	9911385	9933057	9951705	38
23	9859475	9887128	9911771	9933303	9951990	37
24	9859961	9887564	9912156	9933728	9952274	36
25	9860446	9887999	9912540	9934062	9952557	35
26	9860930	9888433	9912923	9934395	9952840	34
27	9861413	9888866	9913306	9934727	9953122	33
28	9861895	9889298	9913688	9935058	9953403	32
29	9862376	9889729	9914069	9935380	9953683	31
30	9862856	9890159	9914449	9935719	9953962	30
	9	8	7	6	5	

The minutes of the degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the right Sines of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines.

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

	80	81	82	83	84	
30	9862856	9890159	9914449	9935719	9953962	30
31	9863336	9890588	9914828	9936048	9954240	29
32	9863815	9891017	9915206	9936376	9954518	28
33	9864293	9891445	9915584	9936703	9954795	27
34	9864770	9891872	9915961	9937029	9955071	26
35	9865246	9892298	9916337	9937355	9955346	25
36	9865722	9892723	9916712	9937680	9955620	24
37	9866197	9893147	9917086	9938004	9955893	23
38	9866671	9893571	9917459	9938327	9956165	22
39	9867144	9893994	9917832	9938649	9956437	21
40	9867616	9894416	9918204	9938970	9956708	20
41	9868087	9894837	9918575	9939290	9956978	19
42	9868559	9895257	9918945	9939609	9957247	18
43	9869027	9895677	9919314	9939928	9957515	17
44	9869496	9896096	9919682	9940246	9957782	16
45	6869964	9896514	9920049	9940563	9958049	15
46	9870431	9896931	9920416	9940879	9958315	14
47	9870897	9897347	9920782	9941194	9958580	13
48	9871362	9897762	9921147	9941509	9958844	12
49	9871827	9898177	9921511	9941823	9959307	11
50	9872291	9898591	9921874	9942136	9959370	10
51	9872754	9899004	9922236	9942448	9959632	9
52	9873216	9899416	9922598	9942759	9659893	8
53	9873677	9899827	9922959	9943069	9960153	7
54	9874137	9900237	9923319	9943379	9960412	6
55	9874597	9900646	9923678	9943688	9960670	5
56	9875056	9901055	9924036	9943996	9960927	4
57	9875514	9901463	9924393	9944303	9961183	3
58	9875971	9901870	9924750	9944750	9961438	2
59	9876427	9902276	9925106	9944914	9961693	1
60	9876883	9902681	9925461	9945219	9961947	0
	9	8	7	6	5	

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Sines.

The degrees of the Quadrant for the right Sines.

	85	86	87	88	89	
0	9961947	9975640	9986295	9994908	9998477	60
1	9962200	9975843	9986447	9994009	9998527	59
2	9962452	9976045	9986598	9994109	9998576	58
3	9962703	9976246	9986748	9994208	9998625	57
4	9962954	9976446	9986897	9994307	9998673	56
5	9963204	9976645	9987045	9994405	9998720	55
6	9963453	9976843	9987193	9994502	9998766	54
7	9963701	9977040	9987340	9994598	9998811	53
8	9963948	9977237	9987486	9994693	9998855	52
9	9964194	9977433	9987631	9994787	9998889	51
10	9964440	9977628	9987775	9994881	9998942	50
11	9964685	9977822	9987918	9994974	9998984	49
12	9964929	9978015	9988061	9995066	9999025	48
13	9965172	9978207	9988203	9995157	9999065	47
14	9965414	9978398	9988344	9995247	9999104	46
15	9965655	9978589	9988484	9995336	9999143	45
16	9965895	9978779	9988623	9995424	9999181	44
17	9966235	9978968	9988761	9995512	9999218	43
18	9966374	9979156	9988899	9995599	9999254	42
19	9966612	9979343	9989036	9995685	9999289	41
20	9966849	9979530	9989172	9995770	9999323	40
21	9967085	9979716	9989307	9995854	9999356	39
22	9967320	9979901	9989441	9995937	9999389	38
23	9967555	9980083	9989574	9996019	9999421	37
24	9967789	9980268	9989706	9996101	9999452	36
25	9968022	9980450	9989837	9996182	9999482	35
26	9968254	9980631	9989968	9996262	9999511	34
27	9968485	9980811	9990098	9996341	9999539	33
28	9968715	9980992	9990227	6996419	9999560	32
29	9968944	9981170	9990355	9996496	9999593	31
30	9969173	9981348	9990482	9996573	9999619	30
	4	3	2	1	0	

The minutes of the degrees of the Quadrant for the right Sines of the arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the right Sines of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the right Sines.

of the Arches of the same Quadrant.

	85	86	87.	88	89	
30	9969173	9981348	9990482	9996573	9999616	30
31	9969401	9981525	9990628	9996649	9999644	29
32	9969628	9981701	9990734	9996724	9999668	28
33	9969854	9981877	9990859	9996798	9999691	27
34	9970079	9982052	9990983	9996871	9999713	26
35	9970304	9982226	9991106	9996943	9999735	25
36	9970528	9982399	9991228	9997014	9999756	24
37	9970751	9982571	9991349	9997085	9999776	23
38	9970973	9982742	9991470	9997155	9999795	22
39	9971194	9982912	9991590	9997224	9999813	21
40	9971414	9983082	9991709	9997293	9999830	20
41	9971633	9983251	9991827	9997359	9999846	19
42	9971851	9983419	9991944	9997425	9999862	18
43	9972069	9983586	9992060	9997491	9999877	17
44	9972286	9983752	9992175	9997556	9999891	16
45	9972502	9983917	9992290	9997620	9999904	15
46	9972717	9984081	9992404	9997683	9999916	14
47	9972931	9984245	9992517	9997745	9999927	13
48	9973145	9984408	9992629	9997806	9999938	12
49	9973358	9984570	9992740	9997867	9999948	11
50	9973570	9984731	9992850	9997927	9999957	10
51	9973781	9984891	9992960	9997986	9999965	9
52	9973991	9985050	9993069	9998044	9999972	8
53	9974200	9985209	9993177	9998101	9999978	7
54	9974408	9985367	9993284	9998157	9999984	6
55	9974615	9985524	9993390	9998212	9999989	5
56	9974822	9985680	9993495	9998267	9999993	4
57	9975028	9985835	9993599	9998321	9999996	3
58	9975233	9985989	9993703	9998374	9999998	2
59	9975437	9986143	9993806	9998456	9999999	1
60	9975640	9986295	9993908	9998477	1000000	0
	4	3	2	1	0	

The minutes of the degrees of the Quadrant for right Sines of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for right Sines of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

THE TABLE
OF TANGENTS OTHERWISE CALLED THE FRVITFVLL TABLE.

The Table of Tangents.

The degrees of the Quadrant for Tangents.

	0	1	2	3	4	
0	0000	174550	349207	524078	699269	60
1	2909	177459	352120	526995	702193	59
2	5818	180369	355033	529911	705116	58
3	8727	183279	357945	531828	708039	57
4	11635	186189	360858	535745	710962	56
5	14544	189100	363770	538663	713886	55
6	17452	191010	366683	541580	716809	54
7	20361	194920	369596	544498	719733	53
8	23270	197830	372508	547415	722657	52
9	26179	200740	375421	550333	725580	51
10	29088	203650	378334	553251	128504	50
11	31996	206561	381247	556169	731428	49
12	34905	209471	384160	559087	734353	48
13	37814	212381	387073	562005	737277	47
14	40723	215291	389987	564923	740202	46
15	43632	218201	392900	567841	743127	45
16	46541	221111	395814	570759	746052	44
17	49450	224022	398727	573678	748978	43
18	52359	226932	401641	576596	751903	42
19	55268	229842	404554	579514	754829	41
20	58177	232752	507468	582433	757754	40
21	61086	235663	410382	585352	760680	39
22	63995	238574	413295	588270	763606	38
23	66904	241485	416209	591189	766532	37
24	69813	244395	419123	594108	769459	36
25	72722	247306	422037	597028	772385	35
26	75631	250217	424951	599947	775311	34
27	78540	253128	427866	602866	778238	33
28	81450	256038	430780	605786	781164	32
29	84359	258949	433694	608705	784091	31
30	87268	261859	436609	611625	787017	30
	89	88	87	86	85	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The degrees of the Quadrant for the Tangents.

	0	1	2	3	4	
30	87268	261859	436609	611125	787017	30
31	90177	264770	439524	614543	789944	29
32	93086	267681	442438	617464	792871	28
33	95995	270593	445353	620384	795799	27
34	98904	273503	448167	623304	798726	26
35	101810	276414	451182	626225	801653	25
36	104723	279325	454097	629145	804581	24
37	107632	282237	457012	632066	807509	23
38	110541	285148	459927	634986	810437	22
39	113450	288059	462842	637907	813365	21
40	116360	290970	465757	640828	816293	20
41	119269	293882	468672	643749	819221	19
42	122178	296794	471588	646671	822150	18
43	125088	299705	474503	649592	825079	17
44	127997	302617	477419	652514	828008	16
45	130906	305528	480335	655435	830937	15
46	133816	308439	483251	658357	833866	14
47	136725	311352	486166	661278	836795	13
48	139635	314262	489082	664200	839724	12
49	142544	317174	491997	667121	842653	11
50	145454	320085	494913	670043	845583	10
51	148363	322997	497829	672965	848513	9
52	151273	355909	500742	675888	851443	8
53	154182	322821	503662	678810	854374	7
54	159092	331733	506578	681733	857304	6
55	160001	334645	509495	684656	860234	5
56	162911	337558	512411	687578	863164	4
57	165820	340470	515328	690501	866095	3
58	168730	343381	518244	693423	869025	2
59	171640	346295	521161	696346	871956	1
60	174550	349207	524078	699269	874886	0
	89	88	87	86	85	

The minutes of degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	5	6	7	8	9	
0	874886	1051042	1227846	1405408	1583844	60
1	877817	1053983	1230798	1408374	1586826	59
2	880748	1056924	1233751	1411341	1589808	58
3	883680	1059866	1236704	1414308	1592791	57
4	886611	1062808	1239658	1417275	1595774	56
5	889543	1065750	1242612	1420242	1598757	55
6	892475	1068692	1245566	1423210	1601740	54
7	895407	1071634	1248520	1426178	1604723	53
8	898339	1074576	1251474	1429146	1607707	52
9	901271	1077518	1254428	1432115	1610691	51
10	904204	1086461	1257383	1435084	1613675	50
11	907137	1083404	1260338	1438053	1616660	49
12	910070	1086347	1263293	1441022	1619645	48
13	913003	1089291	1266249	1443992	1622630	47
14	915936	1092234	1269205	1446961	1625615	46
15	918870	1095178	1272161	1449931	1627601	45
16	921804	1098122	1275117	1452901	1631587	44
17	924738	1101066	1278073	1455871	1634573	43
18	927771	1104010	1281029	1458842	1637560	42
19	930605	1106954	1283986	1461813	1640547	41
20	933539	1109899	1286943	1464784	1643534	40
21	936473	1112844	1289900	1467755	1646522	39
22	939407	1115789	1292857	1470727	1649510	38
23	942342	1118734	1295815	1473699	1652499	37
24	945277	1121680	1298773	1476671	1655488	36
25	948212	1124625	1301731	1479644	1658477	35
26	951147	1127571	1304689	1482617	1664466	34
27	954083	1130517	1307648	1485590	1664456	33
28	957019	1133463	1310607	1488568	1667446	32
29	959954	1136409	1313566	1491536	1670436	31
30	962890	1139355	1316525	1494510	1673426	30
	84.	83	82.	81	80	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Tangents.

The minutes of degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

	5	6	7	8	9	
30	962890	1139355	1316525	1494510	1673426	30
31	965826	1142302	1319485	1497484	1676417	29
32	968763	1145249	1322445	1500458	1679408	28
33	971699	1148196	1325405	1503433	1682399	27
34	974636	1151144	1328365	1506408	1685390	26
35	977573	1154091	1331325	1509383	1688382	25
36	980509	1157040	1334285	1512358	1691374	24
37	983446	1159988	1337246	1515334	1694366	23
38	986383	1162936	1340207	1518310	1697358	22
39	989320	1165884	1343168	1521286	1700351	21
40	992257	1168832	1346129	1524262	1703344	20
41	995195	1171781	1349091	1527239	1706337	19
42	998133	1174730	1352053	1530216	1709331	18
43	1001072	1177679	1355015	1533193	1712325	17
44	1004010	1180628	1357977	1536170	1715319	16
45	1006949	1183577	1360940	1539148	1718313	15
46	1009887	1186527	1363903	1542126	1721308	14
47	1012825	1189477	1366866	1545104	1724304	13
48	1015763	1192427	1369830	1548082	1727300	12
49	1018702	1195377	1372793	1551061	1730296	11
50	1021641	1198328	1375757	1554040	1733292	10
51	1024580	1201279	1378721	1557019	1736287	9
52	1027519	1204230	1381686	1559999	1739284	8
53	1030459	1207181	1384650	1562979	1742281	7
54	1033399	1210132	1387615	1565959	1745278	6
55	1036339	1213084	1390580	1568939	1748275	5
56	1039279	1216036	1393545	1571920	1751273	4
57	1042219	1218988	1396510	1574901	1754271	3
58	1045160	1221940	1399476	1577882	1757270	2
59	1048101	1224892	1402442	1580863	1760269	1
60	1051042	1227845	1405408	1583844	1763268	0
	84	83	82	81	80	

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	10	11	12	13	14	
0	1763268	1943803	2125565	2308682	2493280	60
1	1766268	1946822	2128605	2311746	2496370	59
2	1769268	1949841	2131646	2314810	2499411	58
3	1772268	1952861	2134687	2317875	2502552	57
4	1775269	1955881	2137729	2320940	2505643	56
5	1778270	1958901	2140771	2324006	2508735	55
6	1781271	1961922	2143814	2327072	2511827	54
7	1784272	1964943	2146857	2330139	2514920	53
8	1787274	1967964	2149900	2333206	2518013	52
9	1790276	1970985	2152944	2336273	2521106	51
10	1793278	1974007	2155988	2339341	2524200	50
11	1796281	1977029	2159032	2342419	2527294	49
12	1799284	1980052	2162077	2345478	2530389	48
13	1802287	1983075	2165122	2348547	2533484	47
14	1805291	1986098	2168167	2351616	2536580	46
15	1808295	1989122	2171213	2354686	2539676	45
16	1811299	1992146	2174259	2357757	2542773	44
17	1814303	1995171	2177306	2360828	2545870	43
18	1817308	1998196	2180352	2363899	2548968	42
19	1820313	2001221	2183400	2366971	2552066	41
20	1823318	2004247	2186448	2370043	2555165	40
21	1826324	2007273	2189496	2373116	2558264	39
22	1829329	2010299	2192544	2376189	2561364	38
23	1832335	2013326	2192544	2379263	2564464	37
24	1835342	2016353	2195593	2382337	2567564	36
25	1838349	2019380	2201692	2385411	2570665	35
26	1841357	2022408	2204742	2388486	2573766	34
27	1844365	2025436	2207792	2391561	2576868	33
28	1847373	2028464	2210843	2394636	2579970	32
29	1850382	2031493	2213894	2397712	2583073	31
30	1853391	2034522	2216946	2400788	2586176	30
	79	78	77	76	75	

The degrees of the Quadrant for the Tangents.

The numbers of the degrees of the Quadrant for the Tangents or the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

	10	11	12	13	14	
30	1853301	2034522	2216946	2400788	2586176	30
31	1856400	2037552	2219998	2403865	2589280	29
32	1859409	2040582	2223051	2406942	2592384	28
33	1862419	2043612	2226104	2410020	2595489	27
34	1865429	2046643	2229157	2413098	2598594	26
35	1868439	2049674	2232211	2416176	2601700	25
36	1871449	2052705	2235265	2419255	2604806	24
37	1874460	2055737	2238319	2422334	2607912	23
38	1877471	2058769	2241374	2425414	2611019	22
39	1880482	2061801	2244429	2428494	2614126	21
40	1883494	2064834	2247485	2431574	2617234	20
41	1886506	2067867	2250541	2434655	2620342	19
42	1889516	2070900	2253597	2437736	2623451	18
43	1892531	2073934	2256654	2440818	2626560	17
44	1895544	2076968	2259711	2443900	2629670	16
45	1898558	2080002	2262769	2446983	2632780	15
46	1901572	2083037	2265827	2450066	2635891	14
47	1904586	2086073	2268885	2453150	2639002	13
48	1907601	2089109	2271944	2456234	2642114	12
49	1910616	2092145	2275003	2459319	2645226	11
50	1913632	2095182	2278063	2462404	2648339	10
51	1916648	2098219	2281123	2465490	2651452	9
52	1999664	2101256	2284183	2468576	2654566	8
53	1922680	2104293	2287244	2471662	2657680	7
54	1925697	2107331	2290305	2474749	2660795	6
55	1928714	2110369	2293367	2477836	2663910	5
56	1931731	2113407	2296429	2480924	2667026	4
57	1934749	2116446	2299492	2484012	2670142	3
58	1937767	2119485	2302555	2487101	2673258	2
59	1940785	2122515	2305618	2490191	2676375	1
60	1943803	2125565	2308682	2493280	2679491	0
	79	78	77	76	75	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the ſame Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	15	16	17	18	19	
0	2679492	2867453	3057307	3249197	3443276	60
1	2682610	2870601	3060487	3252413	3446530	59
2	2685728	2873749	3063669	3255630	3449785	58
3	2688847	2876898	3066851	3258848	3453040	57
4	2691966	2880048	3070034	3262066	3456296	56
5	2695086	2883198	3073218	3265285	3459553	55
6	2698206	2886349	3076402	3268504	3462810	54
7	2701327	2889501	3079587	3271724	3466068	53
8	2704448	2892653	3082772	3274944	3469326	52
9	2707570	2895806	3085958	3278165	3472585	51
10	2710693	2898960	3085144	3281387	3475845	50
11	2713816	2902114	3092331	3284609	3479105	49
12	2716940	2905268	3095518	3287832	3482366	48
13	2720064	2908423	3198706	3291055	3485628	47
14	2723189	2911578	3101895	3294280	3488891	46
15	2726314	2914734	3105084	3297505	3492154	45
16	2729439	2917890	3108274	3300731	3495418	44
17	2732565	2921047	3111464	3303957	3498683	43
18	2735691	2924204	3114655	3307184	3501949	42
19	2738818	2927362	3117846	3310411	3505215	41
20	2741945	2930520	3121038	3313639	3508482	40
21	2745073	2933679	3124230	3316868	3511749	39
22	2748201	2936839	3127423	3320097	3515017	38
23	2751330	2939999	3130617	3323327	3518286	37
24	2754459	2943160	3133811	3326558	3521555	36
25	2757589	2946321	3137006	3329789	3524825	35
26	2760729	2946483	3140201	3333020	3528096	34
27	2763850	2952645	3143397	3336252	3531368	33
28	2766981	2955808	3146594	3339485	3534640	32
29	2770113	2958971	3149791	3342719	3537913	31
30	2773245	2962135	3152989	3345953	3541186	30
	74	73	72	71	70	

The degrees of the Quadrant for the Tangents.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

	15	16	17	18	19	
30	2773245	2962135	3152989	3345953	3541186	30
31	2776378	2965299	3156187	3349188	3544460	29
32	2779511	2968464	3159386	3352423	3547735	28
33	2782645	2971629	3162585	3355659	3551010	27
34	2785779	2974795	3165785	3358896	3554286	26
35	2788914	2977962	3168986	3362133	3557563	25
36	2792050	2981129	3172187	3365371	3560840	24
37	2795186	2984297	3175389	3368610	3564118	23
38	2798323	2987465	3178591	3371850	3567397	22
39	2801460	2990634	3181794	3375090	3570676	21
40	2804597	2993804	3184998	3378331	3573956	20
41	2807735	2996973	3188202	3381572	3577237	19
42	2810873	3000143	3191407	3384814	3580519	18
43	2814012	3003314	3194613	3388057	3583801	17
44	2817151	3006486	3197819	3391300	3587084	16
45	2820291	3009658	3201026	3394544	3590367	15
46	2823432	3012831	3204233	3397798	3593651	14
47	2826573	3016004	3207441	3401033	3596936	13
48	2829714	3019178	3210649	3404279	3600221	12
49	2832856	3022353	3213858	3407525	3603507	11
50	2835999	3025528	3217067	3410772	3606794	10
51	2839142	3028703	3220277	3414020	3610082	9
52	2842286	3031879	3223488	3417268	3613370	8
53	2845430	3035055	3226699	3420517	3616659	7
54	2848525	3038232	3229911	3423766	3619949	6
55	2851720	3041410	3233124	3427016	3623239	5
56	2854866	3044588	3236337	3430267	3626530	4
57	2858012	3047767	3239551	3433518	3629822	3
58	2861159	3050946	3242766	3436770	3633115	2
59	2864306	3054126	3245981	3440023	3636408	1
60	2867453	3057307	3249197	3443276	3639702	0
	74	73	72	71	70	

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	20	21	22	23	24	
0	5639702	3838640	4040262	4244748	4452286	60
1	3642997	3841978	4043647	4248182	4455772	59
2	3646293	3845316	4047031	4251617	4459259	58
3	3649589	3848655	4050416	4255052	4462747	57
4	3652886	3851995	4053802	4258488	4466236	56
5	3656183	3855336	4057189	4261925	4469726	55
6	3659481	3858678	4060577	4265363	4473216	54
7	3662780	3862020	4063966	4268801	4476707	53
8	3666079	3865363	4067356	4265363	4480199	52
9	3669379	3868709	4070747	4268801	4483692	51
10	3672680	3872052	4074139	4272240	4487186	50
11	3675982	3875397	4077531	4279121	4490681	49
12	3679284	3878743	4080924	4282563	4494177	48
13	3682587	3882090	4084318	4286006	4497674	47
14	3685891	3885438	4087713	4289450	4501172	46
15	3689195	3888787	4091109	4292895	4504671	45
16	3692500	3892136	4094506	4296340	4508171	44
17	3695806	3895486	4097903	4299786	4511672	43
18	3699113	3898837	4101301	4303233	4515173	42
19	3702420	3902188	4104699	4306681	4518675	41
20	3705728	3905540	4108097	4310130	4522178	40
21	3709037	3908893	4111497	4310130	4525682	39
22	3712347	3912247	4114898	4313580	4529187	38
23	3715657	3915061	4118300	4317031	4532693	37
24	3718968	3918956	4121703	4327387	4536200	36
25	3722279	3922312	4125107	4330841	4539708	35
26	3725591	3925669	4128511	4334296	4543217	34
27	3728904	3929027	4131916	4337752	4546727	33
28	3732218	3932385	4135322	4341209	4550238	32
29	3735533	3935744	4138728	4344666	4553750	31
30	3738848	3939104	4142135	4348124	4557264	30
	69	68	67	66	65	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Tangents.

The minutes of degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

	20	21	22	23	24	
30	3738848	3939104	4142135	4348124	4557264	30
31	3742164	3942465	4145544	4351583	4560778	29
32	3745480	3945826	4148953	4355045	4564293	28
33	3748797	3949188	4152363	4358504	4567809	27
34	3752115	3952551	4155773	4361966	4571326	26
35	3755434	3955915	4159184	4365429	4574843	25
36	3758753	3959280	4162596	4368893	4578361	24
37	3762073	3962646	4166009	4372357	4581880	23
38	3765394	3966012	4169423	4375822	4585400	22
39	3768716	3969379	4172838	4379288	4588921	21
40	3772038	3972746	4176255	4382755	4592443	20
41	3775361	3976114	4179672	4386223	4595966	19
42	3778685	3979483	4183090	4389692	4599490	18
43	3782010	3982853	4186509	4393162	4603015	17
44	3785335	3986224	4189928	4396633	4606541	16
45	3788661	3989596	4193348	4400105	4610068	15
46	3791988	3992969	4196769	4403578	4613596	14
47	3795315	3996342	4200191	4407051	4617125	13
48	3798643	3999716	4203613	4410525	4620654	12
49	3801972	4003090	4207036	4414000	4624184	11
50	3805302	4006465	4210460	4417476	4627715	10
51	3808632	4009841	4213885	4420953	4631247	9
52	3811963	4013217	4217311	4424432	4634780	8
53	3815295	4016594	4220738	4427910	4638314	7
54	3818628	4019972	4224165	4431390	4641849	6
55	3821961	4023351	4227593	4434871	4645385	5
56	2825295	4026731	4231022	4438352	4648922	4
57	3828630	4030112	4234452	4441834	4652460	3
58	3831966	4033494	4237883	4445317	5655099	2
59	3835303	4036877	4241315	4448801	4659540	1
60	3838640	4040262	4244748	4452286	4663081	0
	69	68	67	66	65	

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for Tangents.

	25	26	27	28	29	
0	4663081	4877328	5095254	5317094	5543090	60
1	4666623	4880930	5098919	5320826	5546893	59
2	4670166	4884533	5102585	5324559	5550697	58
3	4673710	4888137	5106252	5328293	5554503	57
4	4677355	4891741	5109920	5332028	5558310	56
5	4680801	4895347	5113589	5335765	5562118	55
6	4684348	4898953	5117259	5339503	5565927	54
7	4687896	4902560	5120930	5343242	5569738	53
8	4691444	4906168	5124602	5346982	5573550	52
9	4694993	4909777	5128275	5350723	5577363	51
10	4698543	4913387	5131949	5354465	5581177	50
11	4702094	4916998	5135625	5358209	5584993	49
12	4705646	4920610	5139302	5361954	5588810	48
13	4709199	4924223	5142980	5365700	5592628	47
14	4712753	4927838	5146659	5369447	5596447	46
15	4716308	4931454	5150339	5373195	5600268	45
16	4719864	4935071	5154020	5376944	5604090	44
17	4723422	4938689	5157702	5380694	5607913	43
18	4726981	4942308	5161385	5384445	5611737	42
19	4730541	4945928	5165069	5388198	5615562	41
20	4734102	4949549	5168755	5391952	5619388	40
21	4737664	4953171	5172442	5395707	5623216	39
22	4741227	4956794	5176130	5399463	5627045	38
23	4744790	4960418	5179819	5403221	5630875	37
24	4748354	4964043	5183509	5406980	5634707	36
25	4751919	4967669	5187200	5410740	5638540	35
26	4755485	4971296	5190892	5414501	5642374	34
27	4759052	4974924	5194585	5418263	5646210	33
28	4762620	4978553	5198279	5422026	5650047	32
29	4766189	4982184	5201974	5425791	5653885	31
30	4769759	4985816	5205670	5429557	5657725	30
	64	63	62	61	60	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Tangents.

	25	26	27	28	29	
30	4769759	4985816	5205670	5429557	5657725	30
31	4773330	4989448	5209368	5433324	5661566	29
32	4776902	4993081	5213067	5437092	5665408	28
33	4780475	4996716	5216767	5440861	5669251	27
34	4784049	5000352	5220468	5444632	5673096	26
35	4787624	5003989	5224170	5448404	5676942	25
36	4791200	5007627	5227873	5452177	5680789	24
37	4794777	5011266	5231577	5455951	5684637	23
38	4798355	5014906	5235283	5459726	5688486	22
39	4801934	5018547	5238990	5463503	5692337	21
40	4805515	5022189	5242698	5467281	5696189	20
41	4809096	5025832	5246407	5471060	5700043	19
42	4812678	5029476	5250117	5474840	5703898	18
43	4816261	5033121	5253828	5478621	5707754	17
44	4819845	5036767	5257540	5482404	5711611	16
45	4823430	5040414	5261254	5486188	5715469	15
46	4827016	5044062	5264969	5489973	5719329	14
47	4830603	5047712	5268685	5493759	5723190	13
48	4834191	5051363	5272402	5497546	5727052	12
49	4837780	5055015	5276120	5501335	5730916	11
50	4841371	5058668	5279839	5500125	5734781	10
51	4844962	5062322	5283959	5508916	5738647	9
52	4848554	5065977	5287280	5512708	5742515	8
53	4852147	5069633	5291003	5516501	5746384	7
54	4855741	5073299	5294727	5520196	5750254	6
55	4859336	5076948	5298452	5524092	5754125	5
56	4862932	5080607	5302178	5527889	5757998	4
57	4866529	5084267	5205905	5531687	5761872	3
58	4870127	5087928	5309633	5535487	5765747	2
59	4873727	5091590	5313363	5539288	5769624	1
60	4877328	5095254	5317094	5543090	5773502	0
	64	63	62	61	60	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangens.

The degrees of the Quadrant for Tangents.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

	30	31	32	33	34	
0	5773502	6008606	6248693	6494076	6745085	60
1	5777381	6012566	6252738	6498212	6749318	59
2	5781262	6016528	6256785	6502350	6753553	58
3	5785144	6020491	6260834	6506489	6757789	57
4	5789027	6024455	6264884	6510630	6762027	56
5	5792911	6028420	6268935	6514773	6766267	55
6	5796797	6032387	6272988	6518917	6770508	54
7	5800684	6036355	6277042	6523063	6774751	53
8	5804572	6040324	6281098	6527200	6778996	52
9	5808462	6044295	6285155	6531359	6783243	51
10	5812353	6048267	6289214	6535510	6787491	50
11	5816245	6052241	6293274	6539662	6791741	49
12	5820139	6056216	6297336	6543816	6795993	48
13	5824034	6060193	6301399	6547971	6800246	47
14	5827930	6064171	6305464	6552128	6804501	46
15	5831828	6068150	6309530	6556287	6808758	45
16	5835727	6072131	6313598	6560447	6813016	44
17	5839627	6076113	6317667	6564609	6817296	43
18	5843528	6080096	6321738	656877	6821538	42
19	5847431	6084081	6325810	6572937	6825801	41
20	5851335	6088067	6329883	6577103	6830066	40
21	5855241	6092055	6333958	6581271	6834333	39
22	5859148	6096044	6338034	6585440	6838602	38
23	5863056	6100035	6342112	6589611	6842872	37
24	5866966	6104027	6346191	6593784	6847144	36
25	5870877	6108020	6350272	6597958	6851417	35
26	5874789	6112015	6354355	6602134	6855692	34
27	5878702	6116011	6358439	6606312	6859969	33
28	5882617	6120009	6362525	6610491	6864247	32
29	5886533	6124008	6366613	6614672	6868527	31
30	5890450	6128008	6370702	6618855	6872809	30
	59	58	57	56	55	

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Tangents.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the ſame Quadrant.

′	30	31	32	33	34	′
30	5890450	6128008	6370702	6618855	6872809	30
31	5864369	6132010	6374792	6623039	6877093	29
32	5898289	6136013	6378884	6627225	6881379	28
33	5902211	6140018	6382977	6631413	6885666	27
34	5906134	6144024	6387072	6635603	6889955	26
35	5910058	6148032	6391169	6639792	6894246	25
36	5913984	6152041	6395267	6643984	6898539	24
37	5917911	6156052	6399366	6648178	6902833	23
38	5921839	6160064	6403467	6652373	6907129	22
39	5925769	6164077	6407569	6656570	6911426	21
40	5929700	6168092	6411673	6660768	6915725	20
41	5933633	6172108	6415779	6664968	6920026	19
42	5937567	6176126	6419886	6669170	6924329	18
43	5941502	6180147	6423995	6673373	6928634	17
44	5945438	6184168	6428105	6677578	9932940	16
45	5949379	6188190	6432216	6681785	6937248	15
46	5955315	6192213	6436329	6685994	6941558	14
47	5957255	6196237	6440444	6690204	6945869	13
48	5961197	6200263	6444560	6694416	6950182	12
49	5965140	6204290	6458678	6698630	6954497	11
50	5969084	62083 19	6452798	6702845	6958813	10
51	5973030	6212350	6456919	6707062	6963131	9
52	5976776	6216382	6461042	6711281	6967451	8
53	5980926	6220416	6465166	6715501	6971773	7
54	5984876	6224451	6469291	6719723	6976097	6
55	5988827	6228488	6473419	6723946	6980423	5
56	5992780	6232526	6477548	6728171	6984750	4
57	5996734	6246566	6481678	6732397	6989079	3
58	6000690	6240607	6485809	6736625	6993409	2
59	6004647	6244649	6489942	6740854	6997741	1
60	6008606	6248693	6494076	6745085	7002075	0
′	59	58	57	56	55	

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

	35	36	37	38	39	
0	7002075	7265424	7535541	7812856	8097840	60
1	7006411	7269869	7542103	7817542	8102658	59
2	7010749	7274316	7544667	7822230	8107478	58
3	7015088	7278765	7549233	7826920	8112300	57
4	7019429	7283216	7553801	7831612	8117124	56
5	7023772	7287669	7558371	7836306	8121951	55
6	7028117	7292124	7562943	7841002	8126780	54
7	7032463	7296581	7567517	7845700	8131611	53
8	7036811	7301040	7572093	7850400	8136444	52
9	7041161	7305501	7576670	7855102	8141280	51
10	7045513	7309963	7581249	7859807	8146118	50
11	7049867	7314427	7585830	7864514	8150958	49
12	7054223	7318893	7590413	7869223	8155801	48
13	7058581	7323361	7594999	7873934	8160646	47
14	7062940	7327831	7599587	7872647	8165493	46
15	7067301	7332303	7604177	7883363	8170343	45
16	7071664	7336777	7608769	7888081	8175195	44
17	7076029	7341253	7613363	7892801	8180049	43
18	7070395	7345731	7617959	7897523	8184905	42
19	7084763	7350210	7622557	7902247	8189764	41
20	7089133	7354691	7627157	7906973	8194625	40
21	7093505	7359174	7631759	7911701	8199488	39
22	7097879	7363659	7636363	7916433	8204354	38
23	7102254	7368146	7640969	7921166	8209222	37
24	7106631	7372635	7645577	7925901	8214091	36
25	7111010	7377126	7650187	7930638	8218965	35
26	7115391	7381619	7654799	7935378	8223840	34
27	7119773	7386114	7659413	7940120	8228717	33
28	7124167	7390611	7664030	7944864	8233597	32
29	7128543	7395110	7668649	7949610	8238479	31
30	7132931	7399610	7663270	7954358	8243363	30
	54	53	52	51	50	

The degrees of the Quadrant for the Tangents.

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of this same Quadrant.

	35	36	37	38	39	
30	7132931	7399610	7673270	7954358	8243363	30
31	7137321	7404112	7677893	7959109	8248250	29
32	7141713	7408616	7682518	7963862	8253139	28
33	7146106	7413122	7687145	7968617	8258031	27
34	7150501	7417630	7691774	7973374	8262925	26
35	7154898	7422140	7696405	7978133	8267821	25
36	7159297	7426652	7701038	7982895	8272720	24
37	7163698	7431167	7705673	7987659	8277621	23
38	7168100	7435684	7710310	7992425	8282524	22
39	7172504	7440203	7714949	7997193	8287429	21
40	7176910	7444724	7719590	8001963	8292337	20
41	7181318	7449246	7724233	8006736	8297247	19
42	7185728	7453770	7728878	8011511	8302160	18
43	7190140	7458296	7733525	8016088	8307075	17
44	7194554	7462824	7738175	8021067	8311992	16
45	7198970	7476354	7742827	8025849	8316912	15
46	7203387	7471886	7747481	8030633	8321834	14
47	7207806	7476420	7752137	8035419	8326759	13
48	7212227	7480956	7756795	8040207	8331686	12
49	7216650	7485494	7761455	8044997	8336615	11
50	7221075	7490033	7766117	8049790	8341547	10
51	7225502	7494574	7770781	8054585	8346481	9
52	7229931	7499117	7775447	8059382	8351418	8
53	7234362	7503663	7780116	8064181	8356357	7
54	7238794	7508211	7784787	8068983	8361298	6
55	7243228	7512761	7789460	8073787	8366242	5
56	7247664	7517313	7794135	8078593	8371188	4
57	7252102	7521867	7798812	8083401	8376136	3
58	7256541	7526423	7803491	8088212	8381087	2
59	7260982	7530981	7808172	8093025	8386040	1
60	7265424	7535541	7812856	8097840	8390996	0
	54	53	52	51	50	

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangents,

The degrees of the Quadrant for the Tangents.

	40	41	42	43	44	
0	8390996	8692867	9004040	9325151	9656888	60
1	8395954	8697975	9009308	9330591	9662511	59
2	8400915	8703085	9014579	9336034	9668137	58
3	8405878	8708198	9019853	9341480	9673766	57
4	8410844	8713344	9025130	9346929	9679398	56
5	8415812	8718433	9030410	9352381	9685034	55
6	8420782	8723555	9035693	9357835	9690674	54
7	8425754	8728679	9040978	9363292	9696315	53
8	8430729	8733806	9046266	9368752	9701960	52
9	8435706	8738935	9051557	9374215	9707609	51
10	8440686	8744067	9056850	9379682	9713261	50
11	8445668	8749201	9062146	9385152	9718916	49
12	8450653	8754338	9067445	9390625	9724574	48
13	8455640	8759478	9072747	9396101	9730235	47
14	8460630	8764620	9078052	9401580	9735900	46
15	8465622	8769764	9083360	9407062	9741568	45
16	8470617	8774911	9088670	9412547	9747239	44
17	8475614	8780061	9093983	9418034	9752913	43
18	8480614	8785214	9099299	9423524	9758591	42
19	8485617	8790369	9104618	9429017	9764272	41
20	8490622	8795527	9109940	9434513	9769956	40
21	8495629	8800688	9115265	9440012	9775643	39
22	8500639	8805851	9120593	9445514	9781334	38
23	8505651	8811017	9125923	9451019	9787028	37
24	8510666	8816186	9131256	9456528	9792725	36
25	8515683	8821357	9136592	9462040	9798425	35
26	8520703	8826531	9141930	9467555	9804128	34
27	8525725	8831708	9147271	9473072	9809835	33
28	8530750	8836887	9152615	9478594	9815545	32
29	8535777	8842069	9157962	9484118	9821258	31
30	8540806	8847353	9163312	9489645	9826974	30
	49	48	47	46	45	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Tangents.

of the Arches of the same Quadrant.

	40	41	42	43	44	
30	8540806	8847153	9163312	9489645	9826974	30
31	8545838	8852440	9168665	9495175	9832694	29
32	8550872	8857730	9174021	9500708	9838417	28
33	8555909	8863022	9179380	9506244	9844143	27
34	8560949	8868317	9184741	9511783	9849872	26
35	8565991	8873615	9190105	9517325	9855605	25
36	8571036	8878915	9195472	9522870	9861341	24
37	8576083	8884218	9200842	9528419	9867080	23
38	8581133	8889524	9206215	9533971	9872822	22
39	8586185	8894833	9211590	9539526	9878568	21
40	8591239	8900144	9216968	9545084	9884317	20
41	8596296	8905458	9222349	9550645	9890070	19
42	8601355	8910775	9227733	9556209	9895826	18
43	8606417	8916094	9233120	9561776	9901585	17
44	8611482	8921416	9238510	9567346	9907347	16
45	8616549	8926741	9243903	9572919	9913113	15
46	8621619	8932068	9249299	9578495	9918882	14
47	8626692	8937398	9254698	9584074	9924654	13
48	8631767	8942731	9260100	9589656	9930430	12
49	8636845	8948067	9265505	9595241	9936209	11
50	8641926	8953406	9270913	9600830	9941991	10
51	8647009	8958747	9276324	9606422	9947777	9
52	8652095	8964091	9281738	9612017	9953566	8
53	8657183	8969438	9287155	9617615	9959359	7
54	8662273	8974787	9292574	9623216	9965155	6
55	8667366	8980139	9297996	9628820	9970954	5
56	8672461	8985494	9303421	9634427	9976756	4
57	8677559	8990852	9308849	9640037	9982562	3
58	8682659	8996212	9314280	9645651	9988371	2
59	8687762	9001575	9319714	9651268	9994184	1
60	8692867	9006940	9325151	9656888	0000000	0
	49	48	47	46	45	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

′	45 °	46 °	47 °	48 °	′
0	100000000	103553392	107233686	111061124	60
1	100058220	103673232	107329941	111162623	59
2	100116442	103793165	107426202	111191265	58
3	100174669	103913202	107522466	111256345	57
4	100232899	104033343	107618734	111321465	56
5	100291132	104153587	107715006	111386625	55
6	100349368	104273935	107811282	111451825	54
7	100407608	104394387	107907562	111517065	53
8	100465851	104514943	108003845	111582345	52
9	100524097	104635702	108100132	111647668	51
10	100582347	104756365	108196423	111713050	50
11	100642201	104877232	108292718	111778460	49
12	100700658	104997902	108389017	111843920	48
13	100758918	105118976	108485320	111909420	47
14	100817182	105240054	108581625	111974960	46
15	100875449	105361135	108677938	112040545	45
16	100933720	105482220	108774253	112106174	44
17	100992394	105583309	108830572	112171843	43
18	101051272	105704401	108936895	112237555	42
19	101111153	105825497	109043222	112303330	41
20	101170038	105946597	109149554	112369104	40
21	101229926	106067701	109255889	112434943	39
22	101288818	106188808	109362228	112500823	38
23	101347713	106249919	109468571	112566753	37
24	101406611	106501034	109574918	112632726	36
25	101465512	106622155	109681269	112698743	35
26	101524418	106743275	109887624	112764783	34
27	101583327	106864401	109893983	112830883	33
28	101642239	106985531	109900346	112897023	32
29	101701154	107106664	109906713	112963211	31
30	101760073	107227801	109913084	113029443	30
′	44 °	43 °	42 °	41 °	′

The degrees of the Quadrant for the Tangents.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

	45	46	47	48	
30	10176073	10537801	10913084	11302944	30
31	10181996	10543942	10919459	11309571	29
32	10187922	10550087	10925838	11316203	28
33	10193852	10556235	10932221	11322899	27
34	10199785	10562387	10938608	11329480	26
35	10205722	10568543	10945000	11336125	25
36	10211663	10574703	10951396	11342774	24
37	10217607	10580867	10957796	11349428	23
38	10223555	10587034	10964200	11356086	22
39	10229506	10593205	10970608	11362748	21
40	10235460	10599280	10977020	11369415	20
41	10241418	10605559	10983436	11376086	19
42	10247380	10611742	10989856	11382762	18
43	10253345	10617929	10996280	11389442	17
44	10259314	10624119	11002708	11396126	16
45	10265286	10630313	11009140	11402815	15
46	10271262	10636511	11015577	11409508	14
47	10277242	10642713	11022018	11416206	13
48	10283225	10648919	11028463	11422908	12
49	10289212	10655128	11034912	11429615	11
50	10295202	10661341	11041365	11436326	10
51	10301196	10667558	11047832	11443042	9
52	10307193	10673779	11054283	11449762	8
53	10313194	10680004	11060748	11456487	7
54	10319199	10686233	11067218	11463216	6
55	10325207	10692466	11073692	11469950	5
56	10331219	10698702	11080170	11476688	4
57	10337234	10704942	11086652	11483431	3
58	10343253	10711186	11093138	11490178	2
59	10349276	10717434	11099629	11496929	1
60	10355302	10723686	11106124	11503684	0
	44	43	42	41	

The minutes of degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	49	50	51	52	
0	11503684	11917537	12348972	12799416	60
1	11510444	11924580	12356320	12807093	59
2	11517108	11931628	12363673	12814776	58
3	11523977	11938680	12371032	12822465	57
4	11530751	11945737	12378394	12830159	56
5	11537529	11952799	12385762	12837859	55
6	11544312	11959866	12393136	12845565	54
7	11551100	11966938	12400515	12853277	53
8	11557893	11974015	12407999	12860994	52
9	11564691	11981097	12415288	12868717	51
10	11571494	11988183	12422683	12876445	50
11	11578301	11995274	12430083	12884179	49
12	11585112	12002370	12437489	12891919	48
13	11591928	12009471	12444900	12899665	47
14	11598748	12016578	12452317	12907417	46
15	11605572	12023690	12459739	12915175	45
16	11612401	12030807	12467167	12922939	44
17	11619234	12037929	12474600	12930709	43
18	11626072	12045056	12482039	12938485	42
19	11632915	12052188	12489484	12946267	41
20	11639763	12059325	12496934	12954055	40
21	11646615	12066467	12504389	12961848	39
22	11653472	12073614	12511850	12969647	38
23	11660334	12080766	12519316	12977457	37
24	11667200	12087923	12526787	12985263	36
25	11674071	12095085	12534264	12993080	35
26	11680947	12102252	12541746	13000903	34
27	11687827	12109424	12549233	13008732	33
28	11694712	12116601	12556725	13016567	32
29	11701602	12123783	12564222	13024407	31
30	11708497	12130970	12571724	13032253	30
	40	39	38	37	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the little Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Tangents.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

	49°	50	51	52	
30	11708497	12130970	12571724	13032253	30
31	11715396	12138162	12579232	13040105	29
32	11722300	12145359	12586746	13047963	28
33	11729208	12152561	12594265	13055827	27
34	11736121	12159768	12601790	13063697	26
35	11743039	12166981	12609321	13071573	25
36	11749962	12174199	12616858	13079455	24
37	11756989	12181422	12624400	13087343	23
38	11763821	12188650	12631948	13095237	22
39	11770758	12195883	12639501	13103138	21
40	11777700	12203121	12647060	13111045	20
41	11784646	12210364	12654624	13118958	19
42	11791597	12217613	12662194	13126877	18
43	11798553	12224867	12669769	13134802	17
44	11805514	12232126	12677350	13142732	16
45	11812479	12233990	12684937	13150668	15
46	11819449	12246659	12692530	13158610	14
47	11826424	12253933	12700128	13166558	13
48	11833404	12261212	12707732	13174512	12
49	11840388	12268496	12715341	13182472	11
50	11847377	12275786	12722956	13190438	10
51	11854371	12283081	12730577	13198411	9
52	11861370	12290381	12738203	13206390	8
53	11868374	12297687	12745835	13214375	7
54	11875383	12304998	12753473	13222367	6
55	11882397	12311314	12761116	13230365	5
56	11889417	12319635	12768765	13238369	4
57	11896438	12326961	12776420	13246379	3
58	11903466	12334293	12784080	13254396	2
59	11910499	12341630	12791745	13262419	1
60	11917537	12348972	12799416	13270448	0
	40	39	38	37	

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	53	54	55	56	
0	13270448	13763820	14281480	14825610	60
1	13278483	13772243	14290325	14834916	59
2	13286524	13780673	14299177	14844230	58
3	13294571	13789109	14308037	14853553	57
4	13302624	13797552	14316905	14862884	56
5	13310683	13806002	14325780	14872223	55
6	13318749	13814459	14334662	14881570	54
7	13326821	13822922	14343552	14890925	53
8	13334899	13831392	14352451	14909288	52
9	13342984	13839869	14361354	14909659	51
10	13351075	13848352	14370266	14919038	50
11	13359172	13856842	14379186	14928426	49
12	13367276	13865339	14388113	14937822	48
13	13375386	13873843	14397048	14947226	47
14	13383502	13882354	14405990	14956638	46
15	13391624	13890872	14414939	14966058	45
16	13399753	13899397	14423896	14975486	44
17	13407888	13907930	14432861	14984923	43
18	13416029	13916470	14441833	14994368	42
19	13424177	13925017	14450812	15003821	41
20	13432331	13933571	14459799	15013283	40
21	13440492	13942131	14468794	15022753	39
22	13448659	13950698	14477797	15032231	38
23	13456832	13959272	14486807	15041717	37
24	13465011	13967853	14495825	15051211	36
25	13473197	13976441	14504850	15060714	35
26	13481390	13985035	14513883	15070225	34
27	13489589	13993636	14522924	15079744	33
28	13497794	14002244	14531972	15089271	32
29	13506006	14010859	14541028	15078807	31
30	13514224	14019481	14550091	15108351	30
	36	35	34	33	

The degrees of the Quadrant for the Tangents.

The minutes of the degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The Table of Tangents.

of the Arches of the ſame Quadrant.

	53	54	55	56	
30	13514224	14019481	14550091	15108351	30
31	13522449	14028110	14559162	15117903	29
32	13530689	14036746	14568241	15127464	28
33	13538918	14045389	14577327	15137034	27
34	13547162	14054040	14586421	15146612	26
35	13555413	14062698	14595523	15156199	25
36	13563670	14071363	14604633	15165794	24
37	13571834	14080035	14613750	15175398	23
38	13580104	14088715	14622875	15185011	22
39	13588381	14097402	14632007	15194632	21
40	13596764	14106097	14641146	15204261	20
41	13605054	14114798	14650293	15213899	19
42	13613350	14123506	14659449	15223545	18
43	13621653	14132221	14668613	15233200	17
44	13629963	14140923	14677785	15242863	16
45	13638279	14149672	14686965	15252535	15
46	13646602	14158409	14696153	15262216	14
47	13654932	14167153	14705349	15271905	13
48	13663268	14175904	14714553	15281603	12
49	13671610	14184663	14723765	15291309	11
50	13679959	14193429	14732985	15301024	10
51	13688315	14202202	14742212	15310748	9
52	13696677	14210982	14751447	15320481	8
53	13705046	14219769	14760690	15330222	7
54	13713422	14228563	14769941	15339972	6
55	13721805	14237365	14779200	15349730	5
56	13730194	14246174	14788466	15359497	4
57	13738590	14254990	14797740	15369273	3
58	13746993	14263813	14807022	15379057	2
59	13755403	14272643	14816312	15388850	1
60	13763820	14281480	14825610	15398651	0
	36	35	34	33	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the ſame Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	57	58	59	60	
0	15398651	16003347	16342794	17320508	60
1	15408461	16013710	16653766	17332150	59
2	15418280	16024083	16664749	17343804	58
3	15428108	16034466	16675742	17355469	57
4	15437945	16044859	16686746	17367146	56
5	15447791	16055261	16697760	17378834	55
6	15457646	16065673	16708785	17390534	54
7	15467510	16076095	16719820	17402246	53
8	15477382	16086527	16730866	17413969	52
9	15487263	16096968	16741922	17425704	51
10	15497153	16107419	16752989	17437451	50
11	15507052	16117880	16764067	17449210	49
12	15516960	16128351	16775156	17460981	48
13	15526877	16138832	16786256	17472764	47
14	15536803	16149322	16797367	17484559	46
15	15546738	16159822	16808489	17496366	45
16	15556682	16170332	16819621	17508185	44
17	15566636	16180852	16830764	17520026	43
18	15576599	16191381	16841918	17531869	42
19	15586571	16201920	16853083	17543724	41
20	15596552	16212469	16864259	17555591	40
21	15606542	16224028	16875446	17567470	39
22	15616541	16233597	16886644	17579362	38
23	15626549	16244176	16897853	17591266	37
24	15636566	16254766	16909074	17603182	36
25	15646592	16265366	16920306	17615111	35
26	15656627	16275976	16931549	17627052	34
27	15666671	16286596	16942803	17639006	33
28	15676724	16297226	16954068	17650972	32
29	15686786	16307866	16965344	17662951	31
30	15696857	16318516	16976631	17674941	30
	32	31	30	29	

The degrees of the Quadrant for the Tangents.

The minutes of degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

	57	58	59	60	
30	15696857	16318516	16976631	17674941	30
31	15706938	16329176	16987929	17686945	29
32	15717028	16339847	16999239	17698960	28
33	15727127	16350528	17010560	17710987	27
34	15737235	16361219	17021892	17723027	26
35	15747353	16371920	17033236	17735079	25
36	15757480	16382631	17044591	17747143	24
37	15767616	16395352	17055957	17759220	23
38	15777761	16404083	17067325	17771309	22
39	15787915	16414824	17078714	17783410	21
40	15798078	16425575	17090115	17795524	20
41	15808251	16436337	17101527	17808651	19
42	15818433	16447109	17112950	17819790	18
43	15828625	16457892	17124384	17831942	17
44	15838827	16468685	17135829	17844107	16
45	15849038	16479488	17147285	17856285	15
46	15859259	16490302	17158752	17868475	14
47	15869489	16501126	17170231	17880678	13
48	15879729	16511960	17181821	17892894	12
49	15889979	16522805	17193222	17905123	11
50	15900238	16533660	17204734	17917364	10
51	15910507	16544526	17216258	17929618	9
52	15920785	16555402	17227794	17941885	8
53	15931073	16566289	17239342	17954164	7
54	15941370	16577186	17250902	17966456	6
55	15951676	16588094	17262473	17978761	5
56	15961992	16599013	17274056	17991079	4
57	15972317	16609942	17285651	18003410	3
58	15982651	16620882	17297258	18015753	2
59	15992994	16631833	17308877	18028109	1
60	16003347	16642794	17320508	18040478	0
	32	31	30	29	

The minutes of degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	61	62	63	64	
0	18040478	18807265	19626104	20503034	60
1	18052860	18820471	19640225	20518180	59
2	18065255	18833691	19654362	20533344	58
3	18077663	18846925	19668516	20548526	57
4	18090084	18860174	19682686	20563726	56
5	18102518	18873437	19696874	20578945	55
6	18114966	18886715	19711074	20594182	54
7	18127427	18900007	19725293	20609437	53
8	18139901	18913314	19739528	20624711	52
9	18152388	18926636	19753780	20640003	51
10	18164889	18929972	19768048	20655313	50
11	18177403	18953323	19782333	20670642	49
12	18189930	18966689	19796634	20685989	48
13	18202470	18980070	19810951	20701355	47
14	18215024	18993466	19825285	20716739	46
15	18227591	19006876	19839635	20732142	45
16	18240171	19020301	19854002	20747564	44
17	18252765	19033741	19868386	20763004	43
18	18265372	19047196	19882786	20778463	42
19	18277992	19060665	19897203	20793941	41
20	18290626	19074149	19911637	20809438	40
21	18303273	19087648	19926088	20824953	39
22	18315934	19101162	19940555	20840487	38
23	18328608	19114691	19955039	20856040	37
24	18341296	19128235	19969540	20871612	36
25	18353997	19141795	19984057	20887202	35
26	18366712	19155370	19998591	20902811	34
27	18379440	19168960	20013142	20918439	33
28	18392182	19182565	20027709	20934086	32
29	18404938	19196185	20042297	20949752	31
30	18417707	19209821	20056898	20965436	30
	28	27	26	25	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Tangents.

	61	62	63	64	
30	18417707	19209821	20056898	20965436	30
31	18430490	19223472	20071516	20981140	29
32	18443287	19237138	20086152	20996863	28
33	18456098	19250819	20100805	21012605	27
34	18468922	19264516	20115475	21028367	26
35	18481760	19278228	20130163	21044148	25
36	18494612	19291955	20144868	21059649	24
37	18507478	19305698	20159590	21075769	23
38	18520357	19319456	20174329	21091609	22
39	18533250	19333230	20189086	21107468	21
40	18546157	19347019	20203860	21123347	20
41	18559078	19360824	20218651	21139246	19
42	18572013	19374644	20233460	21155164	18
43	18584962	19388486	20248286	21171102	17
44	18597925	19402331	20261130	21187059	16
45	18610902	19416198	20277991	21203036	15
46	18623894	19430081	20292870	21219032	14
47	18630900	19443980	20307767	21235048	13
48	18649920	19457894	20322681	21251083	12
49	18662954	19471824	20337613	21267138	11
50	18676002	19485770	20352563	21283213	10
51	18689064	19499732	20367531	21299308	9
52	18702140	19513710	20382516	21315423	8
53	18715231	19527704	20397519	21331558	7
54	18728335	19541714	20411539	21347713	6
55	18741454	19555739	20427577	21363888	5
56	18754587	19569780	20442633	21380085	4
57	18767735	19583837	20457706	21396298	3
58	18780897	19597910	20472797	21412534	2
59	18794074	19611999	20487906	21428796	1
60	18807265	19626104	20503034	21445067	0
	28	27	26	25	

The minutes of degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	65	66	67	68	
0	21445067	22460373	23558529	24750869	60
1	21461364	22477965	23577595	24771613	59
2	21477681	22495582	23596687	24792387	58
3	21494019	22513222	23615805	24813191	57
4	21510377	22530885	23634950	24834024	56
5	21526756	22548571	23654121	24854887	55
6	21543155	22566281	23673318	24875780	54
7	21559575	22584014	23692542	24896704	53
8	21576015	22601771	23711793	24917659	52
9	21592475	22619951	23731071	24938644	51
10	21608956	22637355	23750375	24959659	50
11	21625458	22655183	23769706	24980705	49
12	21641981	22673034	23789064	25001781	48
13	21658525	22690909	23808448	25022890	47
14	21675090	22708808	23827859	25044029	46
15	21691670	22726730	23847297	25065198	45
16	21708283	22744676	23866762	25086398	44
17	21724911	22762646	23886254	25107629	43
18	21741559	22780639	23905773	25128991	42
19	21758228	22798656	23925320	25150183	41
20	21774918	22816696	23944895	25171506	40
21	21791629	22834760	23964496	25192861	39
22	21808362	22852848	23984124	25214248	38
23	21825116	22870960	24003779	25235666	37
24	21841892	22889090	24023462	25257116	36
25	21858689	22907256	24043172	25278597	35
26	21875508	22925441	24062910	25300115	34
27	21892348	22943650	24082675	25321655	33
28	21909210	22961883	24102468	25343231	32
29	21926094	22980141	24122289	25364841	31
30	21943000	22998424	24142137	25386482	30
	24	23	22	21	

The degrees of the Quadrant for the Tangents.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

	88		89	
30	381885288		1145891136	30
31	386178258		1185395877	29
32	390568737		1227736470	28
33	395060088		1273213435	27
34	399655828		1322188681	26
35	404359642		1375082163	25
36	409175388		1432363027	24
37	414111295		1494645462	23
38	419159137		1562590046	22
39	424335793		1637005697	21
40	429641796		1718863124	20
41	435082056		1809337410	19
42	440661780		1909864971	18
43	446386310		2022219818	17
44	452261453		2148619711	16
45	458293185		2291873854	15
46	464487853		2455533838	14
47	470852152		2644433955	13
48	477393195		2864819229	12
49	484118353		3125276745	11
50	491038024		3437829002	10
51	498155754		3819696333	9
52	505482730		4297181900	8
53	513020946		4911098124	7
54	520805157		5729633839	6
55	528821258		6875680006	5
56	537085003		8594003953	4
57	5456109 68		11457529506	3
58	5544 14914		17188033688	2
59	5635043 09		34376070815	1
60	572899830		Infinita.	0
	I		O	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

THE TABLE
OF SECANTS OTHERWISE CALLED THE BENEFICIALL TABLE.



The Table of Secants.

The degrees of the Quadrant for the Secants.

	0	1	2	3	
0	10000000	10001524	10006095	10013723	60
1	10000001	10001574	10006198	10013875	59
2	10000002	10001626	10006301	10014029	58
3	10000004	10001679	10006405	10014184	57
4	10000008	10001733	10006509	10014339	56
5	10000010	10001788	10006615	10014495	55
6	10000014	10001844	10006721	10014653	54
7	10000020	10001900	10006828	10014811	53
8	10000027	10001957	10006936	10014970	52
9	10000034	10002015	10007045	10015130	51
10	10000042	10002074	10007155	10015291	50
11	10000051	10002134	10007265	10015453	49
12	10000060	10002195	10007376	10015615	48
13	10000071	10002256	10007488	10015778	47
14	10000083	10002318	10007601	10015942	46
15	10000095	10002381	10007716	10016107	45
16	10000108	10002445	10007831	10016273	44
17	10000122	10002510	10007946	10016440	43
18	10000137	10002576	10008062	10016608	42
19	10000152	10002642	10008179	10016777	41
20	10000168	10002709	10008298	10016946	40
21	10000186	10002777	10008417	10017116	39
22	10000204	10002846	10008537	10017287	38
23	10000223	10002916	10008658	10017459	37
24	10000243	10002987	10008779	10017632	36
25	10000264	10003058	10008902	10017806	35
26	10000285	10003130	10009025	10017981	34
27	10000308	10003230	10009149	10018157	33
28	10000332	10003277	10009274	10018333	32
29	10000357	10003352	10009400	10018510	31
30	10000381	10003428	10009527	10018687	30
	89	88	87	86	

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Secants.

	73	74	75	76	
30	33759438	36058848	38667125	41652974	30
31	33795535	36099623	38713580	41706424	29
32	33831703	36140483	38760139	41760003	28
33	33867942	36181427	38806801	41813712	27
34	33904252	36222456	38853567	41867550	26
35	33940634	36263570	38900438	41921518	25
36	33977088	36304771	38947416	41975617	24
37	34013615	36346060	38994501	42029848	23
38	34050215	36387437	39041695	42084211	22
39	34086888	36428903	39088998	42138706	21
40	34123634	36470459	39136409	42193334	20
41	34160453	36512103	39183929	42248096	19
42	34197345	36553836	39231557	42302993	18
43	34234310	36595659	39279294	42358025	17
44	34271348	36637572	39327139	42413193	16
45	34308459	36679574	39375094	42468497	15
46	34345644	36721666	39423158	42523937	14
47	34382903	36763849	39471331	42579514	13
48	34420237	36806121	39519614	42635228	12
49	34457647	36848483	39568006	42691080	11
50	34495132	36890936	39616509	42747070	10
51	34532692	36933479	39665124	42803199	9
52	34570327	36976114	39713852	42859468	8
53	34608038	37018840	39762695	42915878	7
54	34645824	37061659	39811654	42972429	6
55	34683686	37104570	39860729	43029122	5
56	34721625	37147574	39909917	43085958	4
57	34759640	37190670	39959218	43142937	3
58	34797733	37233859	40008633	43200060	2
59	34835903	37277141	40058103	43257328	1
60	34874151	37320517	40107808	43314742	0
	16	15	14	13	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the ſame Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	77	78	79	80	
0	43314742	47046295	51445543	56712854	60
1	43372301	47113680	51525561	56809480	59
2	43430006	47181249	51605820	56906425	58
3	43487857	47249003	51686321	57003690	57
4	43545855	47316942	51767065	57101277	56
5	43604000	47385067	51848053	57199188	55
6	43662293	47453380	51929285	57297425	54
7	43720733	47521882	52010762	57395990	53
8	43779321	47590575	52092485	57494885	52
9	43838057	47659460	52174455	57594111	51
10	43896942	47728538	52256673	57693670	50
11	43955977	47797809	52339140	57793564	49
12	44015163	47867274	52421857	57893795	48
13	44074501	47936934	52504826	57994366	47
14	44133992	48006790	52588048	58095279	46
15	44193637	48076841	52671525	58196536	45
16	44253435	48147088	52755259	58298138	44
17	44313387	48217531	52839251	58400087	43
18	44373494	48288171	52923503	58502385	42
19	44433756	48359008	53008016	58605934	41
20	44494174	48430043	53092792	58708035	40
21	44554749	48501278	53177831	58811388	39
22	44615481	48572714	53263134	58915095	38
23	44676371	48644352	53348702	59019157	37
24	44737419	48716193	53434536	59123576	36
25	44798626	48788238	53520637	59228353	35
26	44859993	48860488	53607006	59333490	34
27	44921521	48932945	53693644	59438989	33
28	44983211	49005610	53780552	59544852	32
29	45045065	49078483	53867731	59651081	31
30	45107083	49151565	53955183	59757678	30
	12	11	10	9	

The degrees of the Quadrant for the Tangents.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

	77	78	79	80	
30	45107083	49151565	53955183	59757678	30
31	45169263	49224856	54042909	59864646	29
32	45231607	49298357	54130911	59971987	28
33	45294114	49372069	54219190	60079703	27
34	45356785	49445993	54307748	60187796	26
35	45419621	49520130	54396586	60296268	25
36	45482623	49594481	54485705	60405121	24
37	45545790	49669047	54575107	60514358	23
38	45609123	49743829	54664793	60623981	22
39	45672623	49818827	54754764	60733992	21
40	45736291	49894042	54845022	60844392	20
41	45800128	49969475	54935569	60955184	19
42	45864135	50045127	55029406	61066370	18
43	45928314	50120999	55117535	61177952	17
44	45992666	50197092	55208958	61289930	16
45	46057192	50273407	55300676	61402307	15
46	46121892	50349935	55392692	61515085	14
47	46186767	50246707	55485007	61628267	13
48	46251817	50503605	55577622	61741856	12
49	46318043	50580910	55670539	61855854	11
50	46382445	50658353	55763759	61970263	10
51	46448023	50736025	55857283	62085085	9
52	46513778	50813927	55951112	62200323	8
53	46579711	50892060	56045247	62315979	7
54	46645823	50970425	56139689	62432056	6
55	46712115	51049023	56234439	62548556	5
56	46778587	51127855	56329498	62665481	4
57	46845240	51206922	56424868	62782833	3
58	46912075	51286225	56520550	62900615	2
59	46979093	51365765	56616545	63018829	1
60	47046295	51445543	56712854	63137478	0
	12	11	10	9	

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	81	82	83	84	
0	63137478	71153707	81443502	95143611	60
1	63256564	71304198	81639821	95410585	59
2	63376089	71455313	81837074	95679014	58
3	63496056	71607058	82035268	95948971	57
4	63616468	71759449	82234410	96220411	56
5	63737327	71912459	82434508	96493467	55
6	63858635	72066117	82635570	96767939	54
7	63980394	72220422	82837603	97044063	53
8	64102607	72375376	83040614	97321646	52
9	64225276	72530983	83244610	97600890	51
10	64348404	72687247	83449598	97881716	50
11	64471994	72844173	83655585	98164135	49
12	64596049	73001766	83862572	98448162	48
13	64720571	73160031	84070565	98733810	47
14	64845563	73318972	84279571	99021104	46
15	64971028	73478593	84489598	99310047	45
16	65096969	73638898	84700687	99600655	44
17	65223388	73799892	84912817	99893042	43
18	65350287	73961572	85125995	100187022	42
19	65477669	74123964	85340229	100482822	41
20	65605537	74287052	85555525	100780346	40
21	65733894	74450847	85771891	101079507	39
22	65862743	74615354	85989335	101380525	38
23	65992087	74780577	86207866	101683314	37
24	66121928	74946021	86427493	101987889	36
25	66252268	75113189	86648225	102294266	35
26	66383110	75280586	86870072	102602473	34
27	66514457	75448716	87093043	102912514	33
28	66646313	75617584	87317150	103224405	32
29	66778681	75787195	87542404	103538166	31
30	66911564	75957554	87768816	103853919	30
	8	7	6	5	

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

	81	82	83	84	
30	66911564	75957554	87768816	103853919	30
31	67044965	76128666	87996394	104171468	29
32	67178887	76300536	88225146	104491055	28
33	67313334	76473170	88455079	104812581	27
34	67448309	76646573	88686196	105136063	26
35	67583815	76820751	88918508	105461519	25
36	67719855	76995710	89152021	105788969	24
37	67856423	77171455	89386745	106118428	23
38	67993549	77347991	89622688	106449917	22
39	68131209	77525324	89859858	106783466	21
40	68269416	77703459	90098268	107119198	20
41	68408173	77882402	90337927	107456902	19
42	68547438	78062159	90578848	107796712	18
43	68687350	78242737	90821043	108138767	17
44	68827777	78424142	91064526	108482852	16
45	68968769	78606379	91309309	108829233	15
46	69110326	78789454	91555401	109177805	14
47	69252455	78973371	91802810	109528589	13
48	69395158	79158136	92051546	109881598	12
49	69538439	79343754	92301618	110236864	11
50	69682302	79530231	92553036	110594415	10
51	69826751	79717572	92805759	110954264	9
52	69971789	79905783	93059875	111316432	8
53	70117419	80094869	93315361	111680940	7
54	70263645	80284835	93572238	112047814	6
55	70410470	80475688	93830595	112417202	5
56	70557898	80667435	94090270	112788878	4
57	70705932	80860083	94351448	113163656	3
58	70854576	81053639	94614055	113539681	2
59	71003833	81248110	94878103	113918875	1
60	71153706	81443502	95143611	114300579	0
	8	7	6	5	

The minutes of degrees of the Quadrant for the Tangents of the Arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the complements of the Arches of the ſame Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	85	86	87	
0	114300579	143006601	190811200	60
1	114684819	143606943	191879163	59
2	115071619	144212307	192959095	58
3	115461005	144822757	194051200	57
4	115853017	145438358	195155685	56
5	116247668	146059175	196273146	55
6	116644985	146685275	197403054	54
7	117044995	147316726	198545993	53
8	117447864	147953611	199702191	52
9	117853346	148595987	200871878	51
10	118261757	149244148	202055705	50
11	118672834	149897753	203253093	49
12	119086890	150557233	204464726	48
13	119503669	151222301	205691260	47
14	119923488	151893462	206932111	46
15	120346233	152570581	208188402	45
16	120771937	153253487	209459545	44
17	121200643	153942729	210746693	43
18	121632370	154638158	212049271	42
19	122067151	155339855	213368214	41
20	122505017	156047923	214704085	40
21	122946003	156762433	216056022	39
22	123390142	157483474	217425507	38
23	123837634	158211136	218812405	37
24	124288195	158945509	220217049	36
25	124742169	159686753	221639784	35
26	125199280	160434770	223080983	34
27	125659878	161189849	224540987	33
28	126123842	161952305	226020167	32
29	126591211	162721698	227518902	31
30	127062036	163498660	229037584	30
	4	3	2	

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the ſame Quadrant.

	85	86	87	
30	127062036	163498660	229037584	30
31	127536341	164282764	230576614	29
32	128014165	165074651	232136427	28
33	128495548	165873906	233717425	27
34	128980531	166681172	235320041	26
35	129469305	167496287	236945285	25
36	129961652	168319085	238592501	24
37	130457692	169150247	240262714	23
38	130957670	169989613	241957021	22
39	131461286	170837304	243674732	21
40	131968930	171693461	245417543	20
41	132480297	172558198	247184785	19
42	132995769	173431641	248978216	18
43	133515636	174313925	250797165	17
44	134038804	175205183	252643455	16
45	134566419	176105555	254517088	15
46	135098153	177015180	256417991	14
47	135634096	177934219	258348100	13
48	136174272	178862806	260307416	12
49	136718731	179801085	262296605	11
50	137267523	180749537	264316358	10
51	137820702	181707670	266366704	9
52	138378319	182676299	268449755	8
53	138940429	183654941	270565570	7
54	139507087	184644417	272714927	6
55	140078545	185644562	274898633	5
56	140654481	186655202	277117516	4
57	141235334	178677270	279372435	3
58	141820765	188710414	281664304	2
59	142411234	189755028	283994009	1
60	143006601	190811200	286362498	0
	4	3	2	

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	88		89	
0	286362498		572899830	60
1	288770746		5826104 21	59
2	291219764		592655713	58
3	2937 10598		603057015	57
4	296244357		613825994	56
5	298823024		624990311	55
6	301445987		636564040	54
7	304115322		648591509	53
8	306833212		661050728	52
9	309599077		674016435	51
10	312416191		867500725	50
11	315283945		701531474	49
12	318204757		716149676	48
13	321181137		731385593	47
14	324212583		747289264	46
15	327302782		763899813	45
16	330451272		781259259	44
17	333661982		799432199	43
18	336934467		818463792	42
19	340272744		838430438	41
20	334677949		859395374	40
21	347150587		881427652	39
22	350695255		904627361	38
23	3543 12962		9290810 86	37
24	358006024		954893332	36
25	361776788		982180553	35
26	3656263 88		1011062679	34
27	369560062		1041705454	33
28	373579199		1074263399	32
29	377686614		1108922084	31
30	381885288		1145891136	30
	I		O	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Tangents.

of the Arches of the ſame Quadrant.

	65	66	67	68	
30	21944000	22998424	24142137	25386482	30
31	21959926	23016731	24162013	25408154	29
32	21976874	23035062	24181917	25429858	28
33	21993843	23053418	24201849	25451594	27
34	22010834	23071798	24221809	25473362	26
35	22027846	23090203	24241798	25495162	25
36	22044879	23108632	24261815	25516995	24
37	22061934	23127086	24281890	25538863	23
38	22079011	23145565	24301934	25560758	22
39	22096109	23164068	24322037	25582688	21
40	22113229	23182597	24342169	25604651	20
41	22130372	23201151	24362329	25626647	19
42	22147537	23219730	24382518	25648675	18
43	22164725	23238335	24402735	25670736	17
44	22181935	23256965	24422981	25692830	16
45	22199168	23275621	24443256	25714957	15
46	22216424	23294302	24463559	25737218	14
47	22233703	23313008	24483891	25759312	13
48	22251004	23331740	24504252	25781540	12
49	22268328	23350498	24524641	25803801	11
50	22285675	23369284	24545061	25826096	10
51	22303044	23388092	24565509	25848424	9
52	22320435	23406927	24585986	25870786	8
53	22337848	23425788	24606492	25893181	7
54	22355284	23444674	24627028	25915610	6
55	22372742	23463586	24647594	25938073	5
56	22390223	23482523	24668189	25960569	4
57	22407726	23501486	24688814	25983099	3
58	22425252	23520475	24709469	26005663	2
59	22442800	23539489	24730154	26028261	1
60	22460371	23558529	24750869	26050893	0
	24	23	22	21	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the ſame Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant.

O

The Table of Tangents.

The degrees of the Quadrant for Tangents.

	69	70	71	72	
0	26050893	27474777	29042105	30776834	60
1	26073559	27499665	29069569	30807323	59
2	26096260	27524592	29097080	30837866	58
3	26118996	27549559	29124638	30868465	57
4	26141766	27574565	29152243	30890119	56
5	26164573	27599612	29179895	30929828	55
6	26187411	27624698	29207595	30960593	54
7	26210286	27649827	29235343	30991413	53
8	26233196	27674995	29263139	31022289	52
9	26256141	27700204	29290982	31053221	51
10	26279120	27725453	29318873	31084208	50
11	26302135	27750742	29346811	31115252	49
12	26325185	27776072	29374797	31146352	48
13	26348270	27802443	29402831	31177508	47
14	26371390	27826855	29430913	31208720	46
15	26394546	27852308	29459043	31239989	45
16	26417738	27877803	29487221	31271315	44
17	26440966	27903339	29515446	31302698	43
18	26464229	27928917	29543719	31334138	42
19	26487528	27954536	29572041	31365636	41
20	26510863	27980196	29600411	31397191	40
21	26534234	28005898	29628831	31428805	39
22	26557641	28031642	29657301	31460476	38
23	26581084	28057429	29685820	31492205	37
24	26604563	28083258	29714388	31523992	36
25	26628079	28109129	29743006	31555838	35
26	26651631	28135043	29771674	31587742	34
27	26675220	28160999	29800392	31619705	33
28	26698845	28186998	29829160	31651727	32
29	26722507	28213040	29857978	31683807	31
30	26746206	28239125	29886847	31715946	30
	20	19	18	17	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for Tangents.

	69	70	71	72	
30	26746206	28239125	29886847	31715946	30
31	26769242	28265253	29915765	31748144	29
32	26793716	28291424	29944734	31780401	28
33	26816527	28317638	29973753	31812717	27
34	26841375	28343895	30002823	31845093	26
35	26865260	28379195	30031943	31877528	25
36	26889183	28396539	30061113	31910324	24
37	26913143	28422926	30090334	31942580	23
38	26937141	28449357	30119605	31975197	22
39	26961177	28475832	30148927	32007875	21
40	26985251	28502350	30178299	32040613	20
41	27009362	28528913	30207723	32073413	19
42	27033511	28555520	30237200	32106275	18
43	27057698	28582172	30266730	32139200	17
44	27081922	28608868	30296312	32172187	16
45	27106182	28635608	30325947	32205237	15
46	27130484	28662393	30355635	32238349	14
47	27154823	28689223	30385375	32271524	13
48	27179200	28716096	30415169	32304762	12
49	27203616	28743015	30445015	32338064	11
50	27228070	28769979	30474915	32371430	10
51	27252563	28796987	30504867	32404858	9
52	27277095	28824040	30534873	32438348	8
53	27301667	28851139	30564930	32471901	7
54	27326278	28878283	30595041	32505517	6
55	27350929	28905472	30625205	32539196	5
56	27375620	28932707	30655423	32572937	4
57	27400350	28959988	30685695	32606741	3
58	27425120	28987315	30716020	32640907	2
59	27449929	29014687	30746400	32674536	1
60	27474777	29042105	30776834	32708528	0
	20	19	18	17	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Tangents.

The degrees of the Quadrant for the Tangents.

	73	74	75	76	
0	32708528	34874151	37320517	40107808	60
1	32745286	34912477	37363987	40157569	59
2	32776709	34950881	37407551	40207446	58
3	32810898	34989364	37451210	40257440	57
4	32845153	35027925	37494964	40307552	56
5	32879757	35066565	37538814	40357781	55
6	32913862	35105283	37582760	40408129	54
7	32948317	35144080	37626803	40458596	53
8	32982879	35182956	37670943	40509183	52
9	33017427	35221911	37715180	40559890	51
10	33052082	35260945	37759515	40610718	50
11	33086802	35300059	37803948	40661665	49
12	33121588	35349253	37848479	40712731	48
13	33156441	35378528	37893109	40763917	47
14	33191362	35417883	37937838	40815224	46
15	33226351	35457320	37982666	40866652	45
16	33261408	35496838	38027592	40918201	44
17	33296534	35536438	38072616	40969871	43
18	33331728	35576121	38117740	41021663	42
19	33366990	35615888	38162963	41073577	41
20	33402321	35655739	38208285	41125614	40
21	33437720	35695672	38253708	41177775	39
22	33473188	35735689	38299232	41230062	38
23	33508725	35775789	38344857	41282475	37
24	33544330	35815973	38390584	41335015	36
25	33580005	35856241	38436414	41387683	35
26	33615750	35896593	38482347	41440480	34
27	33651566	35937029	38528384	41493407	33
28	33687453	35977550	38574525	41546464	32
29	33723410	36018156	38620772	41599653	31
30	33759438	36058848	38667125	41652974	30
	16	15	14	13	

The minutes of the degrees of the Quadrant for the Tangents of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Tangents of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Tangents.

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	0	1	2	3	
30	10000381	10003428	10009527	10018687	30
31	10000407	10003505	10009655	10018865	29
32	10000433	10003581	10009783	10019044	28
33	10000461	10003660	10009912	10019224	27
34	10000489	10003739	10010042	10019405	26
35	10000518	10003819	10010174	10019587	25
36	10000548	10003900	10010306	10019770	24
37	10000579	10003982	10010439	10019954	23
38	10000611	10004060	10010572	10020138	22
39	10000643	10004148	10010706	10020324	21
40	10000677	10004231	10010841	10020510	20
41	10000711	10004317	10010977	10020698	19
42	10000746	10004403	10011114	10020886	18
43	10000782	10004490	10011252	10021086	17
44	10000819	10004578	10011390	10021266	16
45	10000857	10004666	10011529	10021456	15
46	10000895	10004755	10011670	10021649	14
47	10000934	10004845	10011811	10021842	13
48	10000975	10004936	10011952	10022035	12
49	10001016	10005028	10012098	10022239	11
50	10001058	10005122	10012238	10022424	10
51	10001100	10005216	10012383	10022620	9
52	10001144	10005310	10012528	10022817	8
53	10001188	10005405	10012674	10023015	7
54	10001233	10005501	10012822	10023213	6
55	10001280	10005598	10012970	10023412	5
56	10001327	10005696	10013119	10023612	4
57	10001375	10005795	10013269	10023813	3
58	10001423	10005894	10013419	10024014	2
59	10001473	10005994	10013570	10024217	1
60	10001524	10006095	10013723	10024420	0
	89	88	87	86	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	4	5	6	7	
0	10024420	10038198	10055082	10075098	60
1	10024625	10038454	10055390	10075459	59
2	10024830	10038710	10055699	10075820	58
3	10025036	10038968	10056009	10076182	57
4	10025242	10039226	10056320	10076545	56
5	10025450	10039486	10056632	10076909	55
6	10025658	10039747	10056944	10077274	54
7	10025868	10040008	10057256	10077639	53
8	10026078	10040269	10057570	10078005	52
9	10026289	10040532	10057884	10078372	51
10	10026500	10040796	10058200	10078740	50
11	10026713	10041061	10058517	10079009	49
12	10026927	10041326	10058834	10079479	48
13	10027141	10041592	10059153	10079850	47
14	10027357	10041859	10059472	10080222	46
15	10027573	10042128	10059792	10080595	45
16	10027790	10042397	10060113	10080968	44
17	10028009	10042667	10060435	10081332	43
18	10028227	10042936	10060757	10081717	42
19	10028447	10043207	10061080	10082093	41
20	10028667	10043479	10061405	10082470	40
21	10028889	10043752	10061730	10082848	39
22	10029111	10044025	10062056	10083226	38
23	10029334	10044300	10062383	10083606	37
24	10029559	10044576	10062711	10083987	36
25	10029784	10044853	10063039	10084368	35
26	10030009	10045130	10063369	10084750	34
27	10030236	10045409	10063700	10085134	33
28	10030463	10045689	10064031	10085518	32
29	10030692	10045969	10064364	10085903	31
30	10030920	10046250	10064696	10086289	30
	85	84	83	82	

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

	4	5	6	7	
30	10030920	10046250	10064696	10086289	30
31	10031150	10046532	10065035	10086677	29
32	10031381	10046815	10065365	10087065	28
33	10031614	10047098	10065701	10087454	27
34	10031846	10047383	10066038	10087843	26
35	10032079	10047669	10066376	10088243	25
36	10032314	10047954	10066715	10088623	24
37	10032550	10048241	10067054	10089015	23
38	10032786	10048529	10067394	10089408	22
39	10033023	10048818	10067735	10089802	21
40	10033261	10049107	10068076	10090196	20
41	10033500	10049398	10068419	10090592	19
42	10033740	10049690	10068763	10090988	18
43	10033981	10049983	10069107	10091385	17
44	10034223	10050276	10069452	10091783	16
45	10034465	10050571	10069808	10092182	15
46	10034708	10050865	10070155	10092582	14
47	10034952	10051160	10070495	10092983	13
48	10035196	10051456	10070842	10093385	12
49	10035441	10051753	10071192	10093787	11
50	10035688	10052051	10071543	10094190	10
51	10035936	10052350	10071895	10094624	9
52	10036184	10052649	10072247	10095030	8
53	10036434	10052951	10072600	10095406	7
54	10036684	10053252	10072954	10095813	6
55	10036934	10053555	10073310	10096221	5
56	10037185	10053858	10073666	10096630	4
57	10037438	10054162	10074023	10097040	3
58	10037690	10054468	10074380	10097451	2
59	10037944	10054775	10074737	10097863	1
60	10038198	10055082	10075098	10098275	0
	85	84	83	82	

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	8	9	10	11	
0	10098275	10124650	10154264	10187166	60
1	10098698	10125117	10154786	10187743	59
2	10099103	10125585	10155308	10188320	58
3	10099518	10126054	20155831	10188899	57
4	10099934	10126524	10156356	10189478	56
5	10100351	10126994	10156881	10190058	55
6	10100769	10127465	10157407	10190639	54
7	10101188	10127947	10157934	10191221	53
8	10101607	10128410	10158462	10191804	52
9	10102028	10128684	10158991	10192387	51
10	10102450	10129358	10159520	10192972	50
11	10102872	10129634	10160051	10193557	49
12	10103295	10130311	10160582	10194144	48
13	10103720	10130788	10161114	10194732	47
14	10104144	10131266	10161648	10195320	46
15	10104570	10131746	10162182	10195910	45
16	10104996	10132226	10621707	10196500	44
17	10105423	10132707	10163252	10197092	43
18	10105851	10133189	10163789	10197684	42
19	10106286	10133672	10164327	10198277	41
20	10106710	10134156	10165865	10198872	40
21	10107140	10134641	10165495	10199467	39
22	10107572	10135127	10165944	10200063	38
23	10108005	10135614	10166485	10200060	37
24	10108438	10136102	10167028	10201258	36
25	10108873	10136591	10167571	10201857	35
26	10109309	10137080	10168116	10202457	34
27	10109755	10137571	10168661	10203058	33
28	10110182	10138163	10169207	10203659	32
29	10110620	10138555	10169765	10204262	31
30	10111059	10139048	10170303	10204867	30
	81	80	79	78	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

°	8	9	10	11	
30	10111059	10139048	10170303	10204867	30
31	10111509	10139543	10170852	10205470	29
32	10111940	10140038	10171401	10206075	28
33	10112482	10140534	10171952	10206681	27
34	10112825	10141036	10172504	10207289	26
35	10113279	10141528	10173056	10207897	25
36	10113713	10142027	10173609	10208506	24
37	10214159	10142526	10174163	10209116	23
38	10114606	10143026	10174718	10209727	22
39	10115053	10143528	10175274	10210339	21
40	10115501	10144030	10175831	10210952	20
41	10115951	10144533	10176389	10211566	19
42	10116401	10145037	10176947	10211180	18
43	10116852	10145542	10177507	10212796	17
44	10117303	10146048	10178068	10213412	16
45	10117754	10146554	10178630	10214030	15
46	10118200	10147062	10179193	10214668	14
47	10118663	10147572	10179756	10215268	13
48	10119118	10148082	10180321	10215889	12
49	10119574	10148593	10180886	10216510	11
50	10120031	10149104	10181453	10217113	10
51	10120489	10149615	10182021	10217756	9
52	10120948	10150128	10182589	10218380	8
53	10121408	10150642	10183158	10219015	7
54	10121868	10151156	10183728	10219631	6
55	10122330	10151672	10184299	10220258	5
56	10122792	10152188	10184870	10220885	4
57	10123256	10152705	10185443	10221514	3
58	10123720	10153224	10186017	10222143	2
59	10124275	10153744	10186591	10222774	1
60	10124650	10154264	10187166	10223405	0
	81	80	79	78	

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	12	13	14	15	
0	10223405	10263040	10306130	10352762	60
1	10224037	10263730	10306884	10353569	59
2	10224671	10264420	10307633	10354377	58
3	10225305	10265112	10308383	10355186	57
4	10225941	10265804	10309134	10355995	56
5	10226577	10265498	10309886	10356807	55
6	10227215	10267192	10310639	10357619	54
7	10227854	10267888	10311393	10358433	53
8	10228493	10268584	10312148	10359247	52
9	10229134	10269281	10312903	10360063	51
10	10229775	10269979	10313660	10360880	50
11	10230417	10270688	10314417	10361698	49
12	10231060	10271379	10315176	10362517	48
13	10231644	10272080	10315935	10363337	47
14	10232288	10272782	10316696	10364158	46
15	10232994	10273485	10317457	10364980	45
16	10233641	10274190	10318220	10365802	44
17	10234289	10274895	10318984	10366626	43
18	10234938	10275601	10319749	10367450	42
19	10235587	10276318	10320525	10368276	41
20	10236238	10277016	10321282	10369102	40
21	10239889	10277726	10322050	10369930	39
22	10237541	10278436	10322819	10370758	38
23	10238195	10279148	10323589	10371588	37
24	10238849	10279860	10324359	10372418	36
25	10239505	10280573	10325131	10373250	35
26	10240161	10281287	10325903	10374092	34
27	10240818	10282002	10326677	10374916	33
28	10241476	10282717	10327451	10375750	32
29	10242135	10283434	10328127	10376586	31
30	10242795	10284151	10329003	10377422	30
	77	76	75	74	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the Arches of the same Quadrant.

	12	13	14	15	
30	10241795	10284151	10329003	10377422	30
31	10243456	10284870	10329781	10378260	29
32	10244118	10285589	10330559	10379098	28
33	10245782	10286310	10331339	10379938	27
34	10245445	10287032	10332119	10380778	26
35	10246110	10287754	10332902	10381620	25
36	10246776	10288478	10333684	10382463	24
37	10247442	10289202	10334467	10383307	23
38	10248110	10289928	10335252	10384153	22
39	10248778	10290654	10336037	10384999	21
40	10249448	10291381	10336824	10385846	20
41	10250119	10292119	10337612	10386694	19
42	10250790	10292838	10338400	10387543	18
43	10251461	10293569	10339189	10388393	17
44	10252136	10294300	10339980	10389244	16
45	10252811	10295043	10340771	10390096	15
46	10253482	10295766	10341564	10390949	14
47	10254162	10296501	10342347	10391803	13
48	10254839	10297237	10343152	10392657	12
49	10255517	10297973	10343947	10393513	11
50	10256196	10298710	10344743	10394370	10
51	10256876	10299449	10345541	10395228	9
52	10257557	10300188	10346340	10396087	8
53	10258239	10300928	10347139	10396947	7
54	10258922	10301669	10347940	10397808	6
55	10259606	10302411	10348741	10398670	5
56	10260291	10303154	10349544	10399533	4
57	10260977	10303898	10350347	10400397	3
58	10261661	10304643	10351151	10401262	2
59	10262351	10305390	10351956	10402128	1
60	10263040	10306136	10352762	10402994	0
	77	76	75	74	

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	16	17	18	19	
0	10402994	10456917	10514621	10576207	60
1	10403862	10457847	10515616	10577267	59
2	10404730	10458779	10516612	10578328	58
3	10405590	10459711	10517609	10579400	57
4	10406471	10460645	10518607	10580463	56
5	10407343	10461580	10519606	10581518	55
6	10408216	10462516	10520606	10582583	54
7	10409091	10463453	10521607	10583650	53
8	10409966	10464391	10522608	10584717	52
9	10410843	10465330	10523611	10585795	51
10	10411721	10466270	10524615	10586855	50
11	10412600	10467211	10525620	10587925	49
12	10413479	10468153	10526626	10588997	48
13	10414360	10469096	10527633	10590070	47
14	10415241	10470041	10528642	10591145	46
15	10416124	10479986	10529651	10592220	45
16	10417007	10471933	10530662	10593297	44
17	10417892	10472880	10531673	10594375	43
18	10418778	10473829	10532686	10595455	42
19	10419665	10474778	10533695	10596534	41
20	10420553	10475729	10534714	10597615	40
21	10421442	10476680	10535730	10598615	39
22	10402333	10477633	10536747	10599780	38
23	10423224	10478587	10537765	10600865	37
24	10424116	10479542	10538785	10601950	36
25	10425009	10480498	10539805	10603037	35
26	10425903	10481454	10540826	10604125	34
27	10426798	10482412	10541848	10605214	33
28	10427694	10483371	10542872	10606304	32
29	10428591	10484331	10543897	10607395	31
30	10429489	10485292	10544923	10608487	30
	73	72	71	70	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the Arches of the same Quadrant.

	16	17	18	19	
30	10429489	10485292	10544923	10608487	30
31	10430388	10486254	10545950	10609580	29
32	10431288	10487217	10546977	10610675	28
33	10432189	10488181	10548006	10611770	27
34	10433091	10489146	10549036	10612867	26
35	10433995	10490113	10550067	10613964	25
36	10434899	10491080	10551099	10615063	24
37	10435805	10492049	10552133	10616163	23
38	10436711	10493018	10553168	10617264	22
39	10437619	10493989	10554204	10618366	21
40	10438528	10494961	10555241	10619469	20
41	10439436	10494934	10556279	10620574	19
42	10440346	10496908	10557318	10621680	18
43	10441257	10497883	10558359	10622787	17
44	10442170	10498059	10559400	10623895	16
45	10443083	10499836	10560443	10625004	15
46	10443998	10500814	10561496	10626114	14
47	10444913	10501793	10562531	10627226	13
48	10445830	10502773	10563577	10628338	12
49	10446749	10503754	10564623	10629451	11
50	10447668	10504736	10565670	10630566	10
51	10448588	10505719	10566719	10631682	9
52	10449509	10506704	10567769	10632799	8
53	10450431	10507689	10568820	10633917	7
54	10451354	10508676	10569872	10635037	6
55	10452279	10509664	10570925	10636157	5
56	10453204	10510653	10571980	10637279	4
57	10454131	10511643	10573034	10638402	3
58	10455058	10512635	10574091	10639526	2
59	10455987	10513627	10575149	10640651	1
60	10456917	10514621	10576207	10641777	0
	73	72	71	70	

of the complements of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	20	21	22	23	
0	10641777	10711449	10785347	10863603	60
1	10642905	10712646	10786616	10864945	59
2	10644034	10713888	10787885	10866289	58
3	10645164	10715042	10789155	10867633	57
4	10646295	10716242	10790427	10868979	56
5	10647427	10717444	10791700	10870326	55
6	10648560	10718647	10792674	10871675	54
7	10649694	10719850	10794250	10873024	53
8	10650829	10721056	10795527	10874374	52
9	10651965	10722261	10796805	10875626	51
10	10653103	10723469	10798085	10877079	50
11	10654242	10724677	10799365	10878434	49
12	10655381	10725887	10800647	10879790	48
13	10656522	10727098	10803214	10881147	47
14	10657664	10728310	10803214	10882506	46
15	10658807	10729524	10804500	10883865	45
16	10659951	10730738	10805787	10885226	44
17	10661097	10731953	10807074	10886588	43
18	10662244	10733170	10808363	10887952	42
19	10663392	10734387	10809652	10889317	41
20	10664541	10735606	10810942	10890683	40
21	10665692	10736826	10812234	10892051	39
22	10666844	10738048	10813528	10893417	38
23	10667996	10739270	10814823	10894788	37
24	10669150	10740494	10816119	10896159	36
25	10670304	10741719	10817417	10897531	35
26	10671460	10742945	10818715	10898905	34
27	10672617	10744173	10820015	10900280	33
28	10673776	10745401	10821316	10901656	32
29	10674936	10746631	10822617	10903033	31
30	10676096	10747864	10823920	10904413	30
	69	68	67	66	

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	20	21	22	23	
30	10676096	10747864	10823920	10904413	30
31	10677258	10749094	10825225	10905790	29
32	10678420	10750327	10826531	10907171	28
33	10679584	10751561	10827838	10908053	27
34	10680749	10752797	10829146	10909936	26
35	10681915	10754034	10830455	10911322	25
36	10683082	10755273	10831766	10912709	24
37	10684250	10756513	10833078	10914046	23
38	10685420	10757753	10834391	10915484	22
39	10686519	10758995	10835706	10916874	21
40	10687763	10760237	10837023	10918265	20
41	10688936	10761481	10838341	10919657	19
42	10690111	10762726	10839660	10921051	18
43	10691287	10763972	10840980	10922436	17
44	10692464	10765220	10842301	10923833	16
45	10693642	10766469	10843623	10925241	15
46	10694821	10767720	10844947	10926641	14
47	10696001	10768971	10846272	10928041	13
48	10697182	10770224	10847597	10929442	12
49	10698364	10771477	10848924	10930846	11
50	10699548	10772732	10850252	10932249	10
51	10700732	10773988	10851583	10933654	9
52	10701918	10775244	10852914	10935061	8
53	10703105	10776502	10854246	10936469	7
54	10704294	10777761	10855578	10937879	6
55	10705483	10779022	10856912	10939290	5
56	10706674	10780284	10858247	10940702	4
57	10707866	10781547	10859584	10942115	3
58	10709059	10782802	10860922	10943527	2
59	10710254	10784078	10862262	10944945	1
60	10711449	10785347	10863603	10946362	0
	69	68	67	66	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	24	25	26	27	
0					
1	10946362	11033783	11126021	11223262	60
2	10947781	11035280	11127601	11224927	59
3	10949201	11036779	11129182	11226593	58
4	10950622	11038279	11130765	11228260	57
5	10952045	11039780	11132349	11229929	56
6	10953469	11041283	11133933	11231599	55
7	10954898	11042787	11135519	11233270	54
8	10956320	11044293	11137106	11234943	53
9	10957747	11045799	11138694	11236617	52
10	10959175	11047306	11140284	11238292	51
11	10960605	11048815	11141875	11239969	50
12	10962036	11050325	11143467	11241648	49
13	10963469	11051837	11145061	11243329	48
14	10964903	11053350	11146656	11245011	47
15	10966338	11054865	11148254	11246694	46
16	10967775	11056381	11149853	11248378	45
17	10969213	11057898	11151453	11250064	44
18	10970652	11059420	11153055	11251751	43
19	10972092	11060939	11154658	11253440	42
20	10973533	11062461	11156262	11255130	41
21	10974976	11063985	11157868	11256822	40
22	10976420	11065510	11159475	11258516	39
23	10977865	11067037	11161084	11260211	38
24	10979312	11068564	11162694	11261907	37
25	10980760	11070092	11164306	11263605	36
26	10982210	11071621	11165919	11265304	35
27	10983661	11073152	11167533	11267005	34
28	10985113	11074684	11169149	11268707	33
29	10986567	11076218	11170766	11270410	32
30	10988022	11077753	11172385	11272114	31
	10989480	11079289	11174006	11273820	30
	65	64	63	62	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Secants.

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	24	25	26	27	
30	10989480	11079289	11174006	11273820	30
31	10990538	11080827	11175627	11275528	29
32	10992398	11082366	11177246	11277238	28
33	10993859	11083906	11178873	11278949	27
34	10995321	11085448	11180499	11280661	26
35	10996783	11086990	11182125	11282374	25
36	10998247	11088536	11183753	11284089	24
37	10999712	11090082	11185383	11285805	23
38	11001179	11091629	11187014	11287524	22
39	11002647	11093178	11188647	11289244	21
40	11004116	11094729	11190281	11290965	20
41	11005587	11096280	11191916	11292688	19
42	11007059	11097833	11193553	11294412	18
43	11008533	11099387	11195191	11296132	17
44	11010008	11100943	11196831	11297864	16
45	11011484	11102500	11198472	11299593	15
46	11019262	11104058	11200114	11301324	14
47	11014441	11105617	11201758	11303056	13
48	11015921	11107179	11203404	11304789	12
49	11017402	11108741	11205051	11306523	11
50	11018884	11110306	11206700	11308259	10
51	11020367	11111871	11208550	11309996	9
52	11021852	11113438	11210001	11311735	8
53	11023338	11115006	11211654	11313476	7
54	11024826	11116575	11213308	11315218	6
55	11026315	11118145	11214963	11316961	5
56	11027806	11119717	11216620	11318706	4
57	11029298	11121290	11218278	11319452	3
58	11030791	11122865	11219938	11322199	2
59	11032287	11124442	11221599	11323949	1
60	11033783	11126021	11223262	11325700	0
	65	64	63	62	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	28	29	30	31	
0	11325700	11433540	11547004	11666331	60
1	11327452	11435384	11548944	11668371	59
2	11329206	11437230	11550886	11670413	58
3	11330961	11439078	11552829	11672457	57
4	11332718	11440927	11554774	11674502	56
5	11334479	11442777	11556720	11676548	55
6	11336237	11444629	11558669	11678597	54
7	11337999	11446483	11560619	11680647	53
8	11339762	11448339	11562570	11682698	52
9	11341526	11450196	11564523	11684752	51
10	11343292	11452054	11566480	11686807	50
11	11345060	11453915	11568434	11688864	49
12	11346830	11455776	11570393	11690923	48
13	11348601	11457639	11572353	11692984	47
14	11350373	11459503	11574314	11695046	46
15	11352149	11461370	11576277	11697110	45
16	11353923	11463238	11578242	11699176	44
17	11355698	11465107	11580208	11701243	43
18	11357475	11466978	11582175	11703312	42
19	11359255	11468850	11584145	11705383	41
20	11361036	11470723	11586116	11707455	40
21	11362819	11472599	11588089	11709530	39
22	11364603	11474483	11590064	11711606	38
23	11366389	11476354	11592040	11713684	37
24	11368177	11478235	11594018	11715764	36
25	11369966	11480117	11595998	11717845	35
26	11371756	11482001	11597979	11719928	34
27	11373548	11483887	11599961	11722012	33
28	11375341	11485774	11601945	11724099	32
29	11377136	11487662	11603932	11726187	31
30	11378933	11489553	11605919	11728276	30
	61	60	59	58	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	28	29	30	31	
30	11378933	11489353	11169591	11728276	30
31	11380731	11491445	11607909	11730367	29
32	11382530	11493338	11609900	11732460	28
33	11384331	11495233	11611893	11734555	27
34	11386134	11497140	11613888	11736652	26
35	11387938	11499028	11615876	11738751	25
36	11389744	11500928	11617882	11740851	24
37	11391551	11502829	11619881	11742953	23
38	11393359	11504731	11621882	11745057	22
39	11395169	11506626	11623885	11747162	21
40	11396981	11508532	11625889	11749269	20
41	11398794	11510450	11627996	11751378	19
42	11400609	11512360	11629904	11753489	18
43	11402425	11514271	11631913	11755603	17
44	11404243	11516183	11633924	11757718	16
45	11406063	11518097	11635937	11759834	15
46	11407884	11520013	11637952	11761951	14
47	11409706	11521930	11639968	11764069	13
48	11411530	11523849	11641986	11766190	12
49	11413356	11525770	11644005	11768312	11
50	11415183	11527692	11646026	11770437	10
51	11417012	11529616	11648049	11772564	9
52	11418842	11531542	11650075	11774696	8
53	11422067	11533469	11652099	11776822	7
54	11422507	11535398	11654127	11778954	6
55	11424342	11537328	11656156	11781088	5
56	11426178	11539260	11658188	11783223	4
57	11428916	11541193	11660221	11785361	3
58	11429856	11543128	11662256	11787500	2
59	11431689	11545065	11664292	11789640	1
60	11433540	11547004	11666331	11791783	0
	61	60	59	58	

The minutes of degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	32	33	34	35	
0	11791783	11923633	12062179	12207745	60
1	11793927	11925886	12064546	12210233	59
2	11796073	11928141	12066916	12212723	58
3	11798221	11930397	12069286	12215214	57
4	11800371	11932656	12071660	12217708	56
5	11802522	11934917	12074036	12220204	55
6	11804675	11937180	12076413	12222702	54
7	11806830	11939445	12078792	12225201	53
8	11808987	11941701	12081174	12227703	52
9	11811145	11943979	12083558	12230207	51
10	11813306	11946250	12085943	12232713	50
11	11815468	11948522	12088330	12235221	49
12	11817632	11950796	12090720	12237732	48
13	11819797	11953071	12093111	12240245	47
14	11821965	11955349	12095504	12242759	46
15	11824134	11957629	12097899	12245275	45
16	11826306	11959610	12100296	12247794	44
17	11828479	11962194	12102696	12250315	43
18	11830654	11964479	12105097	12252837	42
19	11832830	11966766	12107500	12255361	41
20	11835008	11969055	12109905	12257888	40
21	11837188	11971346	12112312	12260417	39
22	11839369	11973638	12114722	12262948	38
23	11841552	11975932	12117133	12265481	37
24	11843737	11978229	12119546	12268016	36
25	11845924	11980527	12121960	12270553	35
26	11848114	11982828	12124377	12273093	34
27	11850305	11985131	12126796	12275634	33
28	11852498	11987435	12129216	12278187	32
29	11854693	11989741	12131638	12280722	31
30	11856890	11992050	12134063	12283270	30
	57	56	55	54	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	32	33	34	35	
30	11850890	11992050	12134063	12283270	30
31	11859088	11994360	12136490	12285820	29
32	11861288	11996672	12138919	12288372	28
33	11863489	11998986	12141350	12290925	27
34	11865693	12001303	12143783	12293481	26
35	11867899	12003619	12146218	12296039	25
36	11870107	12005938	12148656	12298599	24
37	11872316	12008259	12150095	12301161	23
38	11874527	12010582	12153536	12303725	22
39	11876739	12012907	12155978	12306291	21
40	11878954	12015233	12158423	12308859	20
41	11881171	12017562	12160870	12311430	19
42	11883389	12019893	12163319	12314003	18
43	11885609	12022226	12165770	12316578	17
44	11887831	12024560	12168223	12319156	16
45	11890054	12026897	12170677	12321736	15
46	11892280	12029236	12173135	12324317	14
47	11894508	12031576	12175594	12326900	13
48	11896737	12033919	12178055	12329486	12
49	11898968	12036264	12180518	12332074	11
50	11901202	12038610	12182983	12334664	10
51	11903437	12040958	12185450	12337256	9
52	11905674	12043309	12187919	12339851	8
53	11907912	12045661	12190390	12342448	7
54	11910153	12048016	12192864	12345046	6
55	11912395	12050372	12195340	12347646	5
56	11914640	12052730	12197817	12350249	4
57	11916886	12055089	12200296	12352854	3
58	11919133	12057451	12202777	12355460	2
59	11921382	12059814	12205260	12358068	1
60	11923633	12063179	12207745	12360678	0
	57	56	55	54	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	36	37	38	39	
0	12360678	12521357	12690184	12867599	60
1	12363290	12524103	12693070	12870632	59
2	12365906	12526851	12695957	12873667	58
3	12368524	12529601	12698847	12876704	57
4	12371144	12532354	12701739	12879744	56
5	12373766	12535110	12704634	12882787	55
6	12376391	12537867	12707531	12885832	54
7	12379018	12540627	12710430	12888879	53
8	12381647	12543389	12713332	12891929	52
9	12384278	12546152	12716236	12894982	51
10	12386911	12548918	12719143	12898035	50
11	12389546	12551686	12722052	12901094	49
12	12392183	12554456	12724964	12904155	48
13	12394822	12557229	12727878	12907218	47
14	12397464	12560005	12730794	12910283	46
15	12400108	12562783	12733713	12913351	45
16	12402754	12565563	12736635	12916422	44
17	12405402	12568345	12739559	12919494	43
18	12408053	12571130	12742485	12922569	42
19	12410705	12573917	12745413	12925647	41
20	12413359	12576706	12748344	12928727	40
21	12416015	12579597	12751277	12931809	39
22	12418674	12582912	12754213	12934895	38
23	12421335	12585087	12757131	12937983	37
24	12433998	12587885	12760092	12941073	36
25	12426663	12590685	12763035	12944166	35
26	12429331	12593488	12765981	12947262	34
27	12432001	12596293	12768929	12950360	33
28	12434673	12599101	12771880	12953461	32
29	12437348	12601911	12774833	12956565	31
30	12440024	12604724	12777788	12959671	30
	53	52	51	50	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Secants.

of the Arches of the same Quadrant.

	36	37	38	39	
30	12440024	12604724	12777788	12959671	30
31	12442701	12607539	12780736	12962780	29
32	12445383	12610356	12783707	12965892	28
33	12448066	12613175	12786670	12969007	27
34	12450751	12615997	12789635	12972124	26
35	12453438	12618821	12792602	12975243	25
36	12456128	12621648	12795573	12978366	24
37	12458821	12624477	12798546	12981491	23
38	12461516	12627308	12801521	12984618	22
39	12464213	12630141	12804498	12987747	21
40	12466913	12632977	12807478	12990880	20
41	12469614	12635815	12810460	12994015	19
42	12472317	12638555	12813445	12997153	18
43	12475022	12641597	12816432	13000293	17
44	12477730	12644343	12819422	13003436	16
45	12480440	12646191	12822415	13006582	15
46	12483152	12650041	12825410	13009730	14
47	12485866	12652893	12828407	13012881	13
48	12488583	12655748	12831407	13016034	12
49	12491302	12658605	12834409	13019189	11
50	12494022	12661464	12837414	13022348	10
51	12496743	12664325	12840421	13025509	9
52	12499469	12667189	12843431	13028673	8
53	12502197	12670050	12846443	13031839	7
54	12504927	12672924	12849458	13035008	6
55	12507659	12675795	12852475	13038180	5
56	12510394	12678668	12855495	13041354	4
57	12513132	12681543	12858517	13044530	3
58	12515871	12684421	12861542	13047710	2
59	12518613	12687301	12864569	13050892	1
60	12521357	12690184	12867699	13054077	0
	53	52	51	50	

The minutes of the degree of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant,

The Table of Secants.

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	40	41	42	43	
0	13054077	13250231	13456326	13673275	60
1	13057264	13253482	13459851	13676986	59
2	13060455	13256835	13463380	13680700	58
3	13063646	13260192	13466912	13684417	57
4	13066843	13263582	13470447	13688138	56
5	13070042	13266915	13473985	13691861	55
6	13073242	13270282	13477527	13695587	54
7	13076445	13273651	13481071	13699316	53
8	13079651	13277023	13484618	13703048	52
9	13082859	13280397	13488168	13706783	51
10	13086071	13283775	13491721	13710523	50
11	13089285	13287155	13495276	13714266	49
12	13092502	13290538	13498835	13718012	48
13	13095721	13293924	13502397	13721761	47
14	13098944	13297313	13505962	13725514	46
15	13102169	13300704	13509530	13729270	45
16	13105397	13304098	13513101	13733029	44
17	13108627	13307495	13516675	13736790	43
18	13111861	13310896	13520252	13740555	42
19	13114098	13314299	13523832	13744322	41
20	13118337	13317705	13527416	13748092	40
21	13121578	13321114	13531003	13751867	39
22	13124823	13324526	13534593	13755644	38
23	13128070	13327941	13538185	13759424	37
24	13131320	13331359	13541781	13763209	36
25	13134572	13334779	13545380	13766997	35
26	13134828	13338203	13548981	13770788	34
27	13141085	13341629	13552585	13774582	33
28	13144346	13345058	13556193	13778380	32
29	13147509	13348490	13559803	13782181	31
30	13150874	13351924	13563417	13785980	30
	49	48	47	46	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	40	41	42	43	
30	13150874	13351924	13563417	13785985	30
31	13154142	13355361	13567034	13789792	29
32	13157413	13358802	13570654	13793603	28
33	13160687	13362245	13574277	13797416	27
34	13163964	13365691	13577903	13801233	26
35	13167243	13369140	13581532	13805053	25
36	13170526	13372592	13585164	13808876	24
37	13173811	13376057	13588799	13812703	23
38	13177099	13379505	13592438	13816534	22
39	13180389	13382966	13596079	13820368	21
40	13183682	13386430	13599723	13824205	20
41	13186978	13389897	13603370	13828045	19
42	13190276	13393367	13607021	13831889	18
43	13193577	13396839	13610975	13835736	17
44	13196882	13400315	13614331	13839586	16
45	13200189	13403794	13617992	13843439	15
46	13203499	13407275	13621656	13847296	14
47	13206812	13410759	13625323	13851156	13
48	13210128	13414247	13628993	13855019	12
49	13213447	13417738	13632666	13858885	11
50	13216769	13421232	13636342	13862755	10
51	13220093	13424728	13640021	13866628	9
52	13223421	13428227	13643704	13870505	8
53	13226750	13431729	13647390	13874385	7
54	13230082	13435234	13651078	13878268	6
55	13233417	13438742	13654769	13882154	5
56	13236754	13442253	13658464	13886044	4
57	13240094	13445767	13662162	13889936	3
58	13243437	13449284	13665863	13893833	2
59	13246783	13452804	13669567	13897733	1
60	13250131	13456329	14673275	13901636	0
	49	48	47	46	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	44	45	46	47	
0	13901636	14142135	14395564	14662790	60
1	13905542	14146251	14399601	14667366	59
2	13909451	14150371	14404242	14671946	58
3	13913365	14154494	14408587	14676530	57
4	13917281	14158621	14412937	14681119	56
5	13921201	14162751	14417290	14685712	55
6	13925126	14166884	14421647	14690309	54
7	13929052	14171021	14426008	14694910	53
8	13932982	14175162	14435374	14699514	52
9	13936916	14179306	14434743	14704122	51
10	13940854	14183454	14439116	14708735	50
11	13944795	14187606	14443493	14713352	49
12	13948739	14191761	14447874	14717973	48
13	13952686	14195919	14452259	14722598	47
14	13956638	14200082	14456648	14727228	46
15	13960592	14204248	14461049	14731862	45
16	13964550	14208418	14465437	14736500	44
17	13968511	14212591	14469838	14741142	43
18	13972476	14216769	14474242	14745788	42
19	13976444	14220950	14478650	14750438	41
20	13980416	14225135	14483062	14755094	40
21	13984391	14229324	14487478	14759753	39
22	13988370	14233517	14491898	14764416	38
23	13992352	14237713	14496322	14769083	37
24	13996338	14241912	14500750	14773755	36
25	14000327	14246115	14505182	14778430	35
26	14004319	14250321	14509617	14783110	34
27	14008315	14254531	14514056	14787794	33
28	14012314	14258745	14518500	14792482	32
29	14016316	14262961	14522946	14797174	31
30	14020322	14267182	14527397	14801871	30
	45	44	43	42	

The degrees of the Quadrant for the Secants.

The numbers of the degrees of the Quadrant for the Secants are the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	44	45	46	47	
30	14020322	14267182	14527397	14801871	30
31	14024332	14271407	14531852	14806571	29
32	14028345	14275635	14536311	14811276	28
33	14032361	14279867	14540773	14815985	27
34	14036381	14284103	14545250	14820698	26
35	14040404	14288343	14549711	14825416	25
36	14044431	14292587	14554186	14830139	24
37	14048461	14296834	14558665	14834866	23
38	14052494	14301086	14563148	14839597	22
39	14056531	14305331	14567635	14844332	21
40	14060572	14309599	14572126	14849072	20
41	14064616	14313861	14576621	14853815	19
42	14068664	14318127	14581120	14858563	18
43	14072715	14322396	14585624	14863315	17
44	14076770	14326670	14590131	14868071	16
45	14080829	14330947	14594642	14872831	15
46	14084891	14335228	14599157	14877597	14
47	14088956	14339513	14603676	14882377	13
48	14093026	14343802	14608199	14887141	12
49	14097099	14348095	14612725	14891919	11
50	14101175	14352391	14617256	14896701	10
51	14105255	14356691	14621791	14901487	9
52	14109339	14360995	14626330	14906278	8
53	14113427	14365303	14630873	14911073	7
54	14117518	14369615	14635421	14915873	6
55	14121612	14373930	14639973	14920677	5
56	14125709	14378350	14644528	14925486	4
57	14129810	14382573	14649087	14930299	3
58	14133915	14386900	14653651	14935116	2
59	14138023	14391230	14658218	14935116	1
60	14142135	14395564	14662790	14944764	0
	43	44	43	42	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Secants.

	48	49	50	51	
0	14944764	15242532	15557239	15890158	60
1	14949594	15247634	15562635	15895869	59
2	14954429	15252741	15568036	15901586	58
3	14959268	15257852	15573441	15907307	57
4	14964112	15262969	15578852	15913034	56
5	14968960	15268090	15584267	15918760	55
6	14973812	15273216	15589688	15924504	54
7	14978668	15278347	15595114	15930247	53
8	14983530	15283484	15600545	15936095	52
9	14988396	15288626	15605981	15941748	51
10	14993266	15293773	15611422	15947508	50
11	14998104	15298924	15616868	15953273	49
12	15003020	15304080	15622319	15959044	48
13	15007903	15309240	15627775	15964820	47
14	15012791	15314405	15633237	15970603	46
15	15017683	15319574	15639704	15976390	45
16	15022580	15324748	15644177	15982184	44
17	15027481	15329926	15649655	15987983	43
18	15032387	15335109	15655138	15993788	42
19	15037297	15340297	15660626	15999599	41
20	15042212	15345491	15666119	16005416	40
21	15047131	15350689	15671617	16011237	39
22	15052054	15355892	15677121	16017065	38
23	15056982	15361100	15682630	16022898	37
24	15061915	15366313	15688144	16028736	36
25	15066852	15371530	15693663	16034579	35
26	15071791	15376753	15699188	16040429	34
27	15076739	15381980	15704717	16046283	33
28	15081690	15387212	15710252	16052143	32
29	15086645	15392449	15715791	16058008	31
30	15091605	15397692	15721337	16063878	30
	41	40	39	38	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	48	49	50	51	
30	15091605	15397692	15721337	16063878	30
31	15096569	15402939	15726887	16069754	29
32	15101538	15408191	15732443	16075637	28
33	15106571	15413447	15738003	16081524	27
34	15111490	15418708	15743569	16087418	26
35	15116472	15423974	15749141	16093318	25
36	15121459	15429246	15754718	16099224	24
37	15126451	15434522	15760300	16105135	23
38	15131447	15439803	15765889	16111053	22
39	15136447	15445089	15771479	16116976	21
40	15141453	15450380	15777077	16122905	20
41	15146463	15455675	15782680	16128839	19
42	15151478	15460976	15788289	16134779	18
43	15156497	15466182	15793903	16140724	17
44	15161520	15471593	15799523	16146676	16
45	15166548	15476908	15805147	16152634	15
46	15171581	15482229	15810777	16158598	14
47	15176619	15487554	15816412	16164567	13
48	15181661	15492885	15822052	16170542	12
49	15186708	15498220	15827697	16176522	11
50	15191760	15503560	15833349	16182509	10
51	15196816	15508905	15839005	16188501	9
52	15201877	15514256	15844667	16194499	8
53	15206943	15519611	15850335	16200503	7
54	15212013	15524972	15856008	16206513	6
55	15217088	15530338	15861676	16212528	5
56	15222168	15535710	15867370	16218550	4
57	15227253	15541083	15873058	16224577	3
58	15232342	15546463	15878753	16230610	2
59	15237435	15551848	15884453	16236648	1
60	15242532	15557230	15890158	16242692	0
	41	40	39	38	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	52	53	54	55	
0	16242692	16616402	17013017	17434469	60
1	16248742	16622819	17019832	17441715	59
2	16254799	16629243	17026654	17448968	58
3	16260861	16635673	17033482	17456229	57
4	16266929	16642109	17040318	17463499	56
5	16273003	16648551	17047160	17470775	55
6	16279083	16655001	17054010	17478059	54
7	16285169	16661457	17060866	17485351	53
8	16291261	16667919	17067729	17492650	52
9	16297358	16674408	17074599	17499957	51
10	16303461	16680864	17081476	17507272	50
11	16309570	16687345	17088359	17514594	49
12	16315685	16693835	17095250	17521924	48
13	16321806	16700328	17102148	17529262	47
14	16327934	16706829	17109053	17536607	46
15	16334067	16713336	17115965	17543959	45
16	16340197	16719850	17122885	17551319	44
17	16346353	16726361	17129812	17558687	43
18	16352505	16732877	17136747	17566063	42
19	16358663	16739430	17143689	17573446	41
20	16364827	16745970	17150638	17580837	40
21	16370996	16752517	17157593	17588236	39
22	16377172	16759070	17164556	17595643	38
23	16383359	16765629	17171525	17603057	37
24	16389542	16772195	17178502	17610480	36
25	16395736	16778767	17185495	17617909	35
26	16401936	16785347	17192476	17625347	34
27	16408152	16791933	17199472	17632793	33
28	16414365	16798525	17206477	17640246	32
29	16420573	16805124	17213488	17647707	31
30	16426798	16811729	17220507	17655174	30
	37	36	35	34	

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Secants

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	52	53	54	55	
30	16426798	16811729	17220507	17655175	30
31	16433027	16818341	17227532	17662651	29
32	16439263	16824960	17234565	17670136	28
33	16445505	16831585	17241605	17677627	27
34	16451954	16838217	17248653	17685127	26
35	16458008	16844856	17255708	17692635	25
36	16464269	16851502	17262770	17700151	24
37	16470536	16858154	17269839	17707674	23
38	16476809	16864813	17276917	17715206	22
39	16483089	16871479	17284002	17722744	21
40	16489385	16878151	17291095	17730290	20
41	16495668	16884830	17298194	17737844	19
42	16501967	16891515	17305300	17745407	18
43	16508272	16898207	17312413	17752978	17
44	16514582	16904907	17319514	17760555	16
45	16520898	16911613	17326662	17768142	15
46	16527220	16918326	17333798	17775740	14
47	16533548	16925046	17340941	17783343	13
48	16539883	16931772	17348091	17790955	12
49	16546224	16948504	17355249	17798575	11
50	16552571	16945244	17362415	17806203	10
51	16558925	16951990	17369587	17813838	9
52	16565286	16958743	17376767	17821481	8
53	16571642	16965495	17383954	17829132	7
54	16578026	16972270	17391148	17836792	6
55	16584406	16979044	17398350	17844460	5
56	16590792	16985824	17405560	17852135	4
57	16597184	16992611	17412776	17859818	3
58	16603584	16999406	17420000	17867509	2
59	16609989	17006208	17427231	17875209	1
60	16616401	17013017	17434469	17882917	0
	37	36	35	34	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

	56	57	58	59	
0	17882917	18360816	18870800	19416039	60
1	17890632	18369014	18879589	19425445	59
2	17898356	18377251	18888389	19434862	58
3	17906089	18385497	18897196	19444290	57
4	17913830	18393753	18906018	19453727	56
5	17921579	18402017	18914846	19463175	55
6	17929337	18410291	18923685	19472635	54
7	17937102	18418574	18932534	19482114	53
8	17944876	18426865	18941393	19491595	52
9	17952658	18435165	18950261	19501076	51
10	17960448	18443454	18959139	19510578	50
11	17968247	18451792	18968027	19520091	49
12	17976054	18460120	18976926	19529615	48
13	17983869	18468456	18985834	19539150	47
14	17991693	18476802	18994752	19548697	46
15	17999525	18485157	19003680	19558254	45
16	18007365	18493521	19012618	19567822	44
17	18015214	18501895	19021516	19577401	43
18	18023071	18510278	19030523	19586991	42
19	18030936	18518670	19039491	19596592	41
20	18038811	18527072	19048468	19606204	40
21	18046693	18535482	19057455	19615827	39
22	18054584	18543903	19066453	19625462	38
23	18062482	18552332	19075461	19635107	37
24	18070389	18560770	19084480	19644765	36
25	18078305	18569217	19093509	19654434	35
26	18086229	18577674	19102549	19664114	34
27	18094161	18586139	19111598	19673805	33
28	18102102	18594614	19120658	19683507	32
29	18110051	18603098	19129727	19693220	31
30	18118009	18616591	19138807	19702945	30
	33	32	31	30	

The degrees of the Quadrant for the Secants.

of the Arches of the same Quadrant.

	56	57	58	59	
30	18118009	18611591	19138807	19702945	30
31	18125975	18620094	19147837	19712680	29
32	18133950	18629606	19156998	19722428	28
33	18141934	18637127	19166109	19732186	27
34	18149926	18645658	19175231	19741956	26
35	18157927	18654198	19184362	19751738	25
36	18165937	18662748	19193504	19761531	24
37	18173956	18671507	19202656	19771335	23
38	18181984	18679875	19211818	19781141	22
39	18190021	18688452	19220990	19790968	21
40	18198065	18697038	19230172	19800808	20
41	18206118	18705634	19239365	19810658	19
42	18214179	18914239	19248569	19820320	18
43	18222249	18722854	19257783	19830393	17
44	18230328	18731480	19267008	19840277	16
45	18238416	18740115	19276242	19850172	15
46	18246513	18748760	19285488	19860079	14
47	18254618	18757414	19294744	19869997	13
48	18262732	18766078	19304010	19879927	12
49	18270854	18774752	19313287	19889068	11
50	18278986	18783436	19322574	19899820	10
51	18287126	18792130	19331872	19909784	9
52	18295276	18800833	19341181	19919760	8
53	18303434	18809546	19350503	19929748	7
54	18311601	18818268	19359831	19939749	6
55	18319776	18826999	19369172	19949760	5
56	18327961	18835741	19378524	19959784	4
57	18337154	18844492	19387886	19966820	3
58	18344355	18853252	19397260	19979868	2
59	18352567	18862021	19406644	19989928	1
60	18360816	18870800	19416039	10000000	0
	33	32	31	30	

The minutes of the degrees of the Quadrant for the Secans of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

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The degrees of the Quadrant for the Secants.

	60	61	62	63	
0	20000000	20626654	21300545	22026892	60
1	20010083	20637484	21312206	22039475	59
2	20020179	20648338	21323882	22052074	58
3	20030285	20659184	21335570	22064690	57
4	20040404	20670054	21347275	22077322	56
5	20050534	20680937	21358993	22089970	55
6	20060676	20691834	21370727	22102635	54
7	20070832	20702744	21382475	22115316	53
8	20080995	20713667	21394238	22128014	52
9	20091172	20724603	21407016	22140728	51
10	20101361	20735554	21417808	22153459	50
11	20111562	20746517	21429615	22166204	49
12	20121776	20757494	21441438	22178971	48
13	20132001	20768484	21453275	22191751	47
14	20142239	20779488	21465128	22204548	46
15	20152489	20790505	21476995	22217361	45
16	20162751	20801535	21488877	22230191	44
17	20173035	20812579	21500774	22243038	43
18	20183321	20823636	21512686	22255902	42
19	20193619	20834706	21524612	22268782	41
20	20203930	20845791	21536553	22281680	40
21	20214252	20856888	21548509	22294595	39
22	20224588	20868000	21560481	22307526	38
23	20234936	20879125	21572467	22320474	37
24	20245296	20890264	21584469	22333439	36
25	20255669	20901416	21596487	22346420	35
26	20266054	20912582	21608520	22359419	34
27	20276452	20923761	21620568	22372434	33
28	20286863	20934955	21632631	22385466	32
29	20297286	20946102	21644710	22398418	31
30	20307721	20957383	21656804	22411584	30
	29	28	27	26	

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The degrees of the Quadrant for the Secants.

of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	60	61	62	63	
30	20307721	20957383	21656804	22411584	30
31	20318170	20968618	21668913	22424667	29
32	20328630	20979867	21681038	22437768	28
33	20339192	20991130	21693178	22450886	27
34	20349587	21002406	21705333	22464022	26
35	20360084	21013696	21717505	22477175	25
36	20370594	21025001	21729691	22490346	24
37	20381116	21036319	21741893	22503543	23
38	20391751	21047651	21754111	22516748	22
39	20402198	21058997	21766344	22529965	21
40	20412758	21070357	21778593	22543201	20
41	20423331	21081731	21790858	22556358	19
42	20433916	21093119	21803138	22569723	18
43	20444514	21104522	21815434	22583025	17
44	20455126	21115938	21827745	22596336	16
45	20465750	21127368	21840071	22609663	15
46	20476387	21138814	21852415	22623009	14
47	20487037	21150273	21864774	22636372	13
48	20497700	21161747	21877149	22649754	12
49	20508376	21173235	21889539	22663152	11
50	20519064	21184737	21901946	22676569	10
51	20529765	21196253	21914369	22690004	9
52	20540479	21207783	21926808	22703456	8
53	20551205	21219328	21939263	22716924	7
54	20561945	21230887	21951734	22730414	6
55	20572697	21242460	21964220	22743919	5
56	20583463	21254048	21976722	22757443	4
57	20594242	21265650	21989240	22770984	3
58	20605033	21277267	22001775	22784543	2
59	20615837	21288899	22014325	22798120	1
60	20626654	21300545	22026892	22811726	0
	29	28	27	26	

The minutes of degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

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The degrees of the Quadrant for the Secants.

	64	65	66	67	
0	22811726	23662013	24585936	25593051	60
1	22825329	23676784	24602010	25610602	59
2	22838962	23691575	24618107	25628180	58
3	22852612	23706387	24634227	25645783	57
4	22866283	23721220	24650370	25663414	56
5	22879976	23736073	24696536	25681071	55
6	22893674	23750947	24682727	25698764	54
7	22907387	23765842	24698940	25716464	53
8	22921140	23780757	24715178	25734301	52
9	22934901	23795692	24731439	25751965	51
10	22948680	23810648	24747724	25769755	50
11	22962478	23825625	24764033	25787582	49
12	22976294	23840623	24780365	25805417	48
13	22990126	23805642	24796721	25823287	47
14	23003983	23870683	24813101	25841185	46
15	23017855	23885844	24829504	25859104	45
16	23031747	23900827	24845932	25877061	44
17	23045657	23915931	24862383	25895040	43
18	23059586	23931055	24879958	25913046	42
19	23073534	23946200	24895356	25931080	41
20	23087501	23961366	24911878	25949145	40
21	23101486	23976553	24928423	25967230	39
22	23115490	23991762	24944993	25985345	38
23	23129513	24006992	24961587	26003487	37
24	23143556	24022245	24978 205	26021658	36
25	23157616	24037518	24994847	26039855	35
26	23171696	24052814	25011514	26058081	34
27	23185795	24068130	25028205	26076333	33
28	23199913	24083469	25044920	26094614	32
29	23214050	24098850	25061660	26112923	31
30	23228205	24114213	25078426	26131259	30
	25	24	23	22	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the Arches of the same Quadrant.

	64	65	66	67	
30	23228205	24114213	25078426	26131259	30
31	23242380	24129616	25095216	26149623	29
32	23205574	24145041	25112030	26168015	28
33	23270797	24160487	25128869	26186436	27
34	23285021	24175956	25145732	26204884	26
35	23299273	24191445	25161620	26223361	25
36	23313546	24206956	25179532	26241867	24
37	23327838	24222488	25196469	26260400	23
38	23342150	24238043	25213432	26278963	22
39	23356481	24253619	25230418	26297555	21
40	23370832	24269217	25247431	26316176	20
41	23385203	24284838	25264468	26334825	19
42	23399593	24300481	25281531	26353503	18
43	23414003	24316147	25298620	26372209	17
44	23428433	24331835	25315734	26390945	16
45	23442882	24347546	25332874	26409709	15
46	23457351	24363281	25350039	26428502	14
47	23471840	24379038	25367229	26447323	13
48	23486348	24394818	25384445	26466174	12
49	23500876	24410620	25401687	26485053	11
50	23515424	24426446	25418956	26503962	10
51	23529992	24442294	25436250	26522890	9
52	23544580	24458164	25453570	26541867	8
53	23559188	24474056	25470915	26560863	7
54	23573817	24489973	25488286	26579889	6
55	23588565	24505908	25505683	26598945	5
56	23603134	24521869	25523005	26618030	4
57	23617822	24537851	25540553	26637145	3
58	23632532	24553837	25558027	26656251	2
59	23647262	24569885	25575529	26675466	1
60	23662013	24585936	25593051	26694672	0
	25	24	23	22	

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

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The degrees of the Quadrant for the Secants.

	68	69	70	71	
0	26694671	27904284	29238045	30715531	60
1	26713907	27925445	29261433	30741500	59
2	26733172	27946643	29284861	30767516	58
3	26752467	27967873	29308328	30793579	57
4	26771791	27989139	29331835	30819689	56
5	26791145	28010440	29355382	30845846	55
6	26810529	28031776	29378970	30872051	54
7	26829942	28053147	29402599	30898304	53
8	26849390	28074553	29426268	30924605	52
9	26868867	28095994	29449978	30950953	51
10	26888373	28117469	29473728	30977350	50
11	26907910	28138980	29497519	31003793	49
12	26927479	28160527	29521350	31030285	48
13	26947078	28182108	29545222	31056824	47
14	26966709	28203725	29569136	31083412	46
15	26986370	28225378	29593090	31110047	45
16	27006062	28247067	29617087	31136731	44
17	27025785	28268793	29641124	31163462	43
18	27045539	28290553	29665204	31190241	42
19	27065323	28312349	29689326	31217019	41
20	27085138	28334181	29713488	31243945	40
21	27104985	28356049	29737692	31270871	39
22	27124864	28377954	29761938	31297948	38
23	27144774	28399894	29786227	31324873	37
24	27164717	28421871	29810558	31351948	36
25	27184690	28443884	29834931	31379072	35
26	27204686	28465934	29859347	31406247	34
27	27224734	28488021	29883705	31433472	33
28	27244804	28510144	29908306	31460747	32
29	27264906	28532304	29932850	31488072	31
30	27285040	28554501	29957438	31515448	30
	21	20	19	18	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

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of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	68	69	70	71	
30	27285040	28554501	29957438	31515448	30
31	27305205	28576735	29982069	31542873	29
32	27325402	28599007	30006743	31570349	28
33	27345631	28621316	30031460	31597875	27
34	27365893	28643662	30056220	31625453	26
35	27386186	28666045	30081023	31653080	25
36	27406513	28688467	30105870	31680758	24
37	27426872	28710925	30130760	31708486	23
38	27447264	28733422	30155714	31736265	22
39	27467688	28755956	30180672	31764094	21
40	27488145	28778549	30205694	31791974	20
41	27508635	28801139	30230760	31819906	19
42	27529157	28823787	30255871	31847891	18
43	27549722	28846473	30281026	31875929	17
44	27570301	28869196	30306226	31904019	16
45	27590922	28891957	30331460	31932164	15
46	27611578	28914756	30356759	31960358	14
47	27632266	28937594	30382092	31988606	13
48	27652989	28960471	30407470	32016909	12
49	27673745	28983386	30432893	32045263	11
50	27694535	29006340	30458361	32073672	10
51	27715358	29029332	30483873	32102132	9
52	27736215	29052363	30509430	32130649	8
53	27757105	29075435	30535033	32159212	7
54	27778029	29098546	30560682	32187832	6
55	27798987	29121697	30586375	32216504	5
56	27819978	29144888	30612115	32245231	4
57	27841003	29168118	30637890	32274012	3
58	27862060	29191388	30663732	32302846	2
59	27883156	29214697	30689608	32331735	1
60	27904284	29238045	30715531	32360678	0
	21	20	19	18	

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The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	72	73	74	75	
0	32360678	34203038	36279559	38637042	60
1	32389676	34235609	36316402	38679033	59
2	32418726	34268245	36353333	38721117	58
3	32447837	34300947	36390323	38763296	57
4	32477001	34333716	36427401	38805571	56
5	32506219	34366553	36464558	38847941	55
6	32535494	34399452	36501793	38890408	54
7	32564823	34432420	36539107	38932971	53
8	32594209	34465456	36570511	38975632	52
9	32623651	34498557	36613973	39018390	51
10	32653148	34531726	36651525	39061246	50
11	32682701	34564959	36689156	39104200	49
12	32712311	34598259	36726868	39147252	48
13	32741977	34631626	36764660	39190423	47
14	32771699	34665061	36802533	39233653	46
15	32801478	34698564	36840488	39277002	45
16	32831314	34732135	36878524	39320449	44
17	32861207	34765775	36916641	39363994	43
18	32891157	34799483	36954842	39407640	42
19	32921165	34833259	36993127	39451384	41
20	32951231	34867105	37031496	39495228	40
21	32981355	34901024	37069947	39539172	39
22	33011537	34935005	37108402	39583218	38
23	33041776	34966052	37147101	39627364	37
24	33072074	35003172	37185803	39671613	36
25	33102431	35037361	37224589	39715965	35
26	33131846	35071621	37263459	39760420	34
27	33163320	35105952	37302413	39804979	33
28	33193853	35140354	37341453	39849642	32
29	33224444	35174826	37380577	39894411	31
30	33255094	35209369	37419788	39939286	30
	17	16	15	14	

The degrees of the Quadrant for the Secants.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the ſame Quadrant.

	72	73	74	75	
30	33255094	35209369	37419788	39939226	30
31	33285803	35243981	37459081	39984263	29
32	33316571	35278664	37498460	40029344	28
33	33347398	35313418	37537923	40074528	27
34	33378286	35348244	37577471	40119816	26
35	33409132	35383140	37617104	40165289	25
36	33440240	35418110	37656824	40210709	24
37	33471307	35453152	37696632	40256316	23
38	33502436	35488268	37736518	40302033	22
39	33533625	35523456	37776513	40347858	21
40	33564875	35558718	37816588	40393791	20
41	33596187	35594052	37856751	40439834	19
42	33627561	35629460	37897004	40485985	18
43	33658998	35664940	37937146	40532245	17
44	33690497	35700494	37977779	40578613	16
45	33722059	35736121	38018300	40625091	15
46	33754683	35771822	38058912	40671678	14
47	33785370	35807597	38099614	40718374	13
48	33817120	35843447	38140406	40765180	12
49	33848934	35879373	38181288	40812093	11
50	33880813	35915374	38222261	40859121	10
51	33912753	35951451	38263324	40906259	9
52	33944756	35987602	38304479	40953510	8
53	33976821	36023829	38345725	41004876	7
54	34008950	36060132	38387064	41048358	6
55	34041141	36096510	38428495	41095957	5
56	34073395	36132966	38470019	41143668	4
57	34105712	36169497	38511635	41191492	3
58	34138091	36206107	38553344	41239431	2
59	34170523	36242794	38595146	41287425	1
60	34203038	36279559	38637042	41335654	0
	17	16	15	14	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	72	73	74	75	
0	32360678	34203038	36279559	38637042	60
1	32389676	34235609	36316402	38679033	59
2	32418726	34268245	36353333	38721117	58
3	32447837	34300947	36390323	38763296	57
4	32477001	34333716	36427401	38805571	56
5	32506219	34366553	36464558	38847941	55
6	32535494	34399452	36501793	38890408	54
7	32564823	34432420	36539107	38932971	53
8	32594209	34465456	36576511	38975632	52
9	32623651	34498557	36613973	39018390	51
10	32653148	34531726	36651525	39061246	50
11	32682701	34564959	36689156	39104200	49
12	32712311	34598259	36726868	39147252	48
13	32741977	34631626	36764660	39190423	47
14	32771699	34665061	36802533	39233653	46
15	32801478	34698564	36840488	39277002	45
16	32831314	34732135	36878524	39320449	44
17	32861207	34765775	36916641	39363994	43
18	32891157	34799483	36954842	39407640	42
19	32921165	34833259	36993127	39451384	41
20	32951231	34867105	37031496	39495228	40
21	32981355	34901024	37069947	39539172	39
22	33011537	34935005	37108402	39583218	38
23	33041776	34966652	37147101	39627364	37
24	33072074	35003172	37185803	39671613	36
25	33102431	35037361	37224589	39715965	35
26	33131846	35071621	37263459	39760420	34
27	33163320	35105952	37302413	39804979	33
28	33193853	35140354	37341453	39849642	32
29	33224444	35174826	37380577	39894411	31
30	33255094	35209369	37419788	39999286	30
	17	16	15	14	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

	72	73	74	75	
30	33255094	35209369	37419788	39939226	30
31	33285803	35243981	37459081	39984263	29
32	33316571	35278664	37498460	40029344	28
33	33347398	35313418	37537923	40074528	27
34	33378286	35348244	37577471	40119816	26
35	33409132	35383140	37617104	40165289	25
36	33440240	35418110	37656824	40210709	24
37	33471307	35453152	37696632	40256316	23
38	33502436	35488268	37736518	40302033	22
39	33533625	35523456	37776513	40347858	21
40	33564875	35558718	37816588	40393791	20
41	33596187	35594052	37856751	40439834	19
42	33627561	35629460	37897004	40485985	18
43	33658998	35664940	37937146	40532245	17
44	33690497	35700494	37977779	40578613	16
45	33722059	35736121	38018300	40625091	15
46	33754683	35771822	38058912	40671678	14
47	33785370	35807597	38099614	40718374	13
48	33817120	35843447	38140406	40765180	12
49	33848934	35879373	38181288	40812093	11
50	33880813	35915374	38222261	40859121	10
51	33912753	35951451	38263324	40906259	9
52	33944756	35987602	38304479	40953510	8
53	33976821	36023829	38345725	41004876	7
54	34008950	36060132	38387064	41048358	6
55	34041141	36096510	38428495	41095957	5
56	34073395	36132966	38470019	41143668	4
57	34105712	36169497	38511635	41191492	3
58	34138091	36206107	38553344	41239431	2
59	34170523	36242794	38595146	41287425	1
60	34203038	36279559	38637042	41335654	0
	17	16	15	14	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	76	77	78	79	
0	41335654	44454097	48097335	52408433	60
1	41383937	44510183	48163151	52486983	59
2	41432338	44566415	48229350	52565774	58
3	41480856	44622793	48295633	52644807	57
4	41529492	44679318	48362102	52724084	56
5	41578245	44735990	48428756	52803604	55
6	41627117	44792810	48495599	52883368	54
7	41676108	44849777	48562631	52963377	53
8	41725219	44906892	48629854	53043632	52
9	41774450	44964155	48697269	53124134	51
10	41823802	45021567	48764877	53204885	50
11	41873273	45079129	48832678	53285884	49
12	41922863	45136843	48900673	53367134	48
13	41972573	45194707	48968853	53448635	47
14	42022405	45252726	49037249	53530390	46
15	42072357	45310898	49105830	53612399	45
16	42122431	45369223	49174607	53694666	44
17	42172625	45427703	49243590	53777191	43
18	42222942	45486338	49312751	53859976	42
19	42273380	45545127	49382118	53943022	41
20	42323942	45604073	49451684	54026331	40
21	42374627	45663175	49521449	54109903	39
22	42425439	45722435	49591416	54193739	38
23	42476377	45781853	49661584	54277840	37
24	42527442	45841429	49731956	54362207	36
25	42578635	45901164	49802532	54446842	35
26	42629957	45961059	49873313	54531744	34
27	42681409	46021115	49944301	54616915	33
28	42732991	46081333	50015497	54702356	32
29	42784705	46141715	50086901	54788068	31
30	42836551	46202261	50158514	54874053	30
	13	12	11	10	

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the Arches of the same Quadrant.

	76	77	78	79	
30	42836551	46202261	50158514	54874053	30
31	42888527	46262969	50230335	54960312	29
32	42940631	46323841	50302367	55046847	28
33	42992865	46384877	50374619	55133659	27
34	43045229	46446076	50447065	55220751	26
35	43097722	46384877	50519732	55308122	25
36	43150347	46446076	50592614	55395775	24
37	43203103	46630665	50665711	55483710	23
38	43255992	46692527	50739024	55571930	22
39	43309012	46754555	50812553	55660434	21
40	43362166	46816752	50886299	55749226	20
41	43415454	46879117	50960263	55838300	19
42	43468877	46941653	51034447	55927677	18
43	43522435	47004361	51108850	56017340	17
44	43576129	47067242	51183475	56107297	16
45	43629959	47130297	51258321	56197549	15
46	43683925	47193526	51333391	56288099	14
47	43738028	47256930	51408684	56378948	13
48	43792268	47320509	51484204	56470097	12
49	43846646	47384264	51559951	56561548	11
50	43901162	47448195	51635926	56653302	10
51	43955817	47512302	51712129	56745360	9
52	44000612	47576586	51788563	56837723	8
53	44065548	47641048	51865227	56930392	7
54	44120615	47705689	51942124	57023369	6
55	44175844	47770510	52019254	57116653	5
56	44231207	47835511	52096618	57210246	4
57	44286712	47900693	52174216	57304150	3
58	44342362	47966058	52252051	57398367	2
59	44398156	48031605	52330123	57492896	1
60	44454097	48097335	52408433	57587740	0
	13	12	11	10	

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	80	81	82	83	
0	57587740	63924495	71852975	82055127	60
1	57682901	64042118	72002006	82249986	59
2	57778381	64160180	72151659	82445779	58
3	57874180	64278683	72301942	82642513	57
4	57970302	64397632	72452863	82840196	56
5	58066748	64517028	72604421	83038833	55
6	58163520	64636873	72756618	83238436	54
7	48260619	64757168	72909461	83439009	53
8	58358049	64877918	73062954	83640561	52
9	58455810	64999124	73217100	83843097	51
10	58553903	65120789	73371903	84046626	50
11	58652333	65242916	73527367	84251153	49
12	58751099	65365508	73683499	84456680	48
13	58850205	65488566	73840302	84663212	47
14	58949653	65612095	73997782	84870760	46
15	59049444	65736097	74155942	85079327	45
16	59149581	65859675	74314786	85288957	44
17	59250065	65985531	74474318	85499628	43
18	59350898	66110967	74634544	85711347	42
19	59452082	66236886	74795468	85924121	41
20	59553618	66363291	74957095	86137958	40
21	59655506	66490185	75119429	86352864	39
22	59757728	66617572	75282475	86568849	38
23	59860346	66745453	75446238	86785921	37
24	59963291	66873831	75610721	87004089	36
25	60066612	67002708	75775928	87223362	35
26	60170285	67132088	75941864	87443750	34
27	60274319	67261972	76108533	87665261	33
28	60378718	67392365	76275941	87887909	32
29	60483482	67523270	76444091	88111704	31
30	60588615	67654691	76612989	88336657	30
	9	8	7	6	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the Arches of the same Quadrant.

	80	81	82	83	
30	60588615	67654691	76612989	88336657	30
31	60694118	67786629	76782641	88562776	29
32	60799995	67919089	76953050	88790069	28
33	60906246	68052073	77124223	89018543	27
34	61012875	68185585	77296165	89248201	26
35	61119881	68319630	77468882	89479054	25
36	61227271	68454208	77642381	89711108	24
37	61335043	68589313	77816665	89944373	23
38	61443201	68724977	77991740	90178856	22
39	61551749	68861175	78167612	90414568	21
40	61660686	68997920	78344287	90651519	20
41	61770013	69135315	78521769	90889717	19
42	61879735	69273018	78700066	91129181	18
43	61989853	69411469	78879183	91369917	17
44	62100367	69550434	79059128	91611941	16
45	62211280	69689963	79239905	91855263	15
46	62322594	69830059	79421520	92099899	14
47	62434312	69970726	79603976	92345849	13
48	62546437	70111967	79787381	92593126	12
49	62658971	70253786	79971439	92841739	11
50	62771918	70396188	80156456	93091699	10
51	62885274	70539174	80342336	93342963	9
52	62999049	70682751	80529087	93595620	8
53	63113241	70826919	80716713	93849647	7
54	63227855	70971684	80905219	94105066	6
55	63342890	71117047	81094612	94361964	5
56	63458352	71263014	81284899	94620181	4
57	63574240	71409586	81476087	94879901	3
58	63690559	71556760	81668183	95141050	2
59	63807309	71704564	81861195	95403639	1
60	63924495	71852975	82055127	95667689	0
	9	8	7	6	

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

of the complements of the Arches of the same Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	84	85	86	
0	95667689	114737188	143355808	60
1	95933204	115119970	143954694	59
2	96200195	115505313	144558602	58
3	96468673	115893242	145167595	57
4	96738655	116283797	145781740	56
5	97010253	116676991	146401101	55
6	97283267	117072851	147025745	54
7	97557932	117471403	147655740	53
8	97834057	117872815	148291169	52
9	98111843	118276840	148932108	51
10	98391211	118683794	149578791	50
11	98672171	119093414	150230942	49
12	98954738	119506013	150888966	48
13	99236930	119921335	151552578	47
14	99524766	120339625	152222283	46
15	99812250	120760985	152897946	45
16	100101400	121185232	153579394	44
17	100392329	121612482	154267179	43
18	100684851	122042752	154961155	42
19	100979193	122476076	155661396	41
20	101275259	122912485	156368008	40
21	101572962	123352014	157081063	39
22	101872522	123794696	157800648	38
23	102173854	124240732	158526854	37
24	102476971	124689836	159259771	36
25	102781890	125142353	159999560	35
26	103088639	125598007	160746121	34
27	103397202	126057149	161499724	33
28	103707656	126519656	162260744	32
29	104019959	126985568	163028671	31
30	104334254	127454936	163804188	30
	5	4	3	

The degrees of the Quadrant for the Secants.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the ſame Quadrant.

	84	85	86	
30	104334254	127454936	163804188	30
31	104650345	127927785	164586836	29
32	104968474	128404152	165377268	28
33	105288542	128884078	166175067	27
34	105610566	129367704	166980877	26
35	105934564	129854921	167794536	25
36	106260557	130345812	168615879	24
37	106588558	130840395	169445585	23
38	106918589	131338917	170283495	22
39	107250680	131841076	171129820	21
40	107584955	132347264	171984431	20
41	107921201	132857174	172847712	19
42	108259554	133371390	173719700	18
43	108600151	133889600	174600528	17
44	108942779	134411312	175490331	16
45	109287702	134937471	176389247	15
46	109634817	135467749	177297417	14
47	109984143	136002235	178215000	13
48	110335695	136540955	179142131	12
49	110689503	137083887	180078954	11
50	111045597	137631223	181025951	10
51	111403988	138183016	181982628	9
52	111764699	138739177	182949802	8
53	112127750	139299830	183926988	7
54	112493167	139865032	184915009	6
55	112861097	140435034	185913698	5
56	113231316	141009514	186922883	4
57	113604036	141588910	187943432	3
58	113979204	142172885	188975184	2
59	114356941	142761897	190018342	1
60	114737188	143355808	191073059	0
	5	4	3	

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant.

The Table of Secants.

The degrees of the Quadrant for the Secants.

	87	88	89	
0	191073059	286537048	572987998	60
1	192139567	288943841	582696234	59
2	193218044	291391404	592740072	58
3	194308693	293880683	603139919	57
4	195411723	296413087	613907444	56
5	196527729	298990299	625070305	55
6	197656182	301611807	636642580	54
7	198797665	304279687	648655621	53
8	199952408	306996123	661126359	52
9	201120639	309760533	674090521	51
10	202303011	312576192	687573461	50
11	203498943	315442491	701612741	49
12	204709121	318361849	716229489	48
13	205934200	321336774	731453951	47
14	207173596	324366765	747356168	46
15	208428431	327455509	763965262	45
16	209698119	330602545	781323254	44
17	210983811	333811800	799493739	43
18	212284914	337082830	818524878	42
19	213602421	340419652	838490069	41
20	214936837	343823403	859453551	40
21	216287319	347294586	881484374	39
22	217655350	350837799	904682629	38
23	219040792	354454051	929134899	37
24	220443981	358145679	954945691	36
25	221865261	361914968	982231437	35
26	223305005	365763113	1011112129	34
27	224763453	369695332	1041753449	33
28	226241278	373713015	1074309940	32
29	227738558	377818975	1108967170	31
30	229255785	382016194	1145934768	30
	2	1	0	

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the Arches of the same Quadrant.

The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the Arches of the ſame Quadrant.

	87	88	89	
30	229255785	382016194	1145934768	30
31	230793360	386307709	1185438054	29
32	232351718	390696734	1227777193	28
33	233931261	395186630	1273252703	27
34	235532422	399780916	1322226495	26
35	237156211	404483275	1375118522	25
36	238801972	409397566	1432297932	24
37	240470730	414227875	1494678912	23
38	242163582	419278406	1562622042	22
39	243879838	424453607	1637036239	21
40	245621193	429758156	1718892212	20
41	247386980	435196961	1809365043	19
42	249178956	440775230	1909891150	18
43	250996450	446498305	2022234532	17
44	252841285	452371994	2148642981	16
45	254713463	458402271	2291895669	15
46	256612911	464595485	2455554199	14
47	258541565	470958329	2644450861	13
48	260499426	477497828	2864894681	12
49	262487160	484221619	3125282743	11
50	264505458	491139838	3437843546	10
51	266554348	498256113	3819709423	9
52	268635944	505581634	4297193536	8
53	270750304	513128395	4911255640	7
54	272898206	520901152	5729642566	6
55	275080457	528915798	6875687278	5
56	277297985	537178089	8594018365	4
57	279551349	545702599	11458691197	3
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The minutes of degrees of the Quadrant for the Secants of the complements of the Arches of the ſame Quadrant.

of the complements of the Arches of the ſame Quadrant,

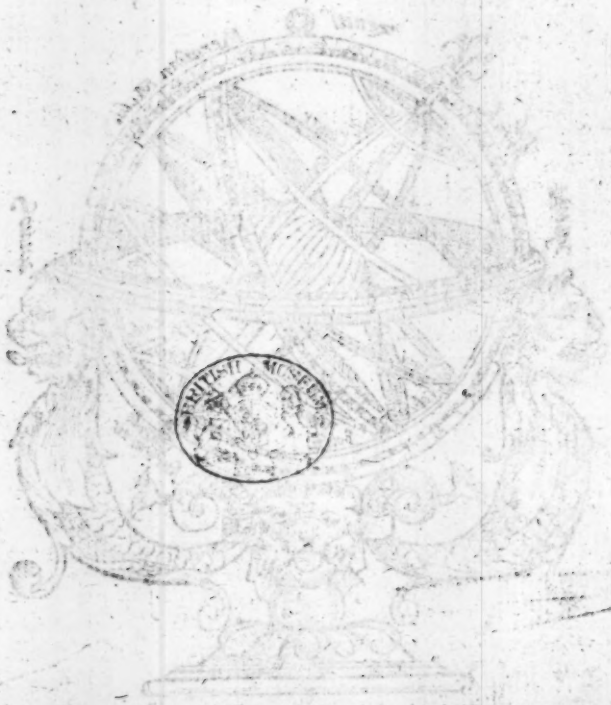
A plaine Treatiſe of the firſt principles of Coſmographie, and ſpecially of the Spheare, repreſenting the ſhape of the whole world:

Together vvith all the chiefeſt and moſt neceſſarie vſes thereof, written by M. *Blundevill* of Newton Flotman. *Anno Dom.* 1594.



The heauens declare the glory of God, and the firmament ſheweth his handy worke. Pſal. 19.

LONDON
Printed by *Iohn Windet*. 1606.



The exposition of certaine termes or principles of *Geometrie*.

MInding to treate of the principles of Cosmographie and especially of the Spheare, I thinke it good first to expound vnto you certaine termes of Geometry, without the which the vnlearned shall hardly vnderstand the contents of this Treatise, which termes are certaine principles of Geometrie, called definitions. For there are but three kindes of principles, whereon the demonstration of all Geometricall conclusions dependeth: that is, definitions, petitions, and maximes but I minde here to deale onely with certaine definitions. Whereof I will set downe as many as I thinke needfull for this purpose in such order as followeth.

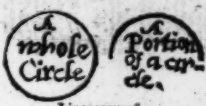
1 A point called in Latine punctus, is a thing supposed to bee indiuisible, hauinge neither lenght, breadth, nor depth, as the point or pricke a.

2 A line called in Latine linea, is a supposed length, hauing neither breadth nor thicknesse, as the line a. b.

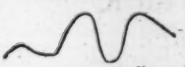
A ——— B

3 The endes or boundes of a line, are two pointes, and of lines some be right, and some be crooked.



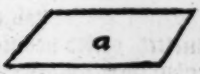


Linea tortuosa.



Linea spiralis

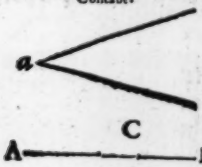




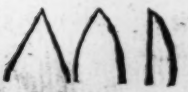
Conuex.



Concaue.



Right. Crooked. Mixt.



4 A right line is that which goeth right from one point to another, and not bowing lie as doth the line c. d but so straight as is possible, as the line a. b. Againe the crooked line is either a whole Circle, or portion of a Circle, or else goeth winding in and out, as a serpent called in Latine Linea tortuosa or else winding about like the shell of a snaile, called of the Latines linea Spiralis, as these figures heere doe shew.

5 Superficies or vpperface, is that which onely hath length and breadth, without depth, which is twofould, that is to say, plaine and crooked.

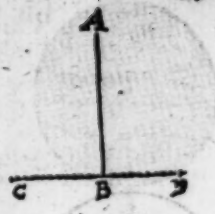
6 The bounds of superficies are lines.

7 A plaine superficies is that which lyeth straight betwixt his lines, as the figure a. & a crooked superficies is that which goeth bowing and lyeth not straight betwixt his lines as the figure b. Againe superficies being considered in an hollow bodie, as a barrell, tunne or vault, may be deuided into two other kinds, that is Conuexe, and Concaue, for the vpper part of such vault is said to be conuexe, & the inward part concaue as the figure b sheweth.

8 A plaine Angle is when two lines being drawne vpon a plaine superficies not directly one against another, but so as by meeting or touching one another in one selfe point, they may make a plaine Angle, as the Angle, a. For if two lines be drawn directly one against another, though they meet in one point, yet they make no Angle, but rather one selfe line as the two lines a. b. meeting in the point c.

9 Of plaine Angles, some are called right line angles, because that both the lines where of it consisteth are right, and some are called

called crooked line angles, because that both lines are crooked, & some are said to be mixt, because the one line is crooked and the other right, as you may perceiue by the three sundry shapes therof made in the Margent.



10. If one right line standing vpon another right line do make two equall angles, that is to say, of each side one, then eyther of those angles that is the right angle, & the line so standing vpon his fellow, is called the perpendicular or plumbe line, as the line a.b. standing vpon the line c.d.



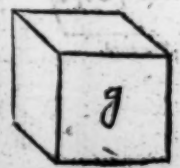
11. A blunt Angle, is that which is greater then a right Angle, as the Angle c.

12. A sharpe Angle, is that which is lesser then a right Angle, as f. so as there be in all three Angles, that is right, blunt, & sharpe, in Latine rectus, obtusus, & acutus: And besides these Angles, there be also certaine Spherical, that is to say, round Angles, which consist of two circular lines drawne vpon a Spherical superficies, which doe crosse one another in some point, either rightly, or obliquely: if rightly, then they make right Angles, on each side of the point where they crosse, as the figure E. sheweth, if obliquely, then they make sharpe Angles on the inside, and blunt Angles on the out side of the point, where they crosse, as the figure F. doth partly shew, for such Angles cannot be so well described in Plano, as vpon the superficies of some Spherical body.





13. A terme called in Latine terminus, is the bound or limite of any thing, as pointes are the bounds of lines, and lines the bounds of superficies, & superficies the bounds of a body, which is that which hath imaginatiuely, but not materially, both length, breadth and depth, and if such body haue many faces



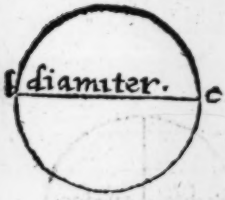


or sides. then it is bounded with many superficiesses, as the figure g. made like a fire square dye. But if such body be round as a bowle, Spheare, or Globe, then it is bounded or couered with one superficies onely, as the figure H. doth shewe.



14 A figure is that which is comprehended within one bound, or many bounds.

15 A circle is a plaine figure bounded with one circular line, which is called the circumference, vnto the which as many right lines as are drawne from the point standing in the midst, are all equall one to the other, that is to say, one is as long as an other, as the figure I. here doth shew.

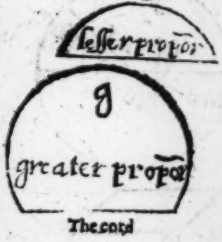


16 And the middle point of a Circle is called the Center, as the point A. in the figure I.

17 The Diameter of the Circle, is a right line passing through the Center, from one side of the Circumference to the other, which deuideth the Circle into two equall parts, as the line B.C.



18 A Semicircle is a figure, contained within the Diamter and halfe the Circumference of a Circle as the figure C,D.E.



19 The portion of a Circle, is a part of a Circle, greater or lesser then the Semicircle, as the figures F. and G, doe shewe, the right line in eyther of which figures is called in Latine chorda, in English the string, and the Circular line in Latine is called arcus in English the bowe, but the Diameter is alwies the greatest chord in a circle,

20 Right line figures, are those which are bounded with right lines.

21 The

21 Triangles or three cornerd figures are those which are bounded with three right lines as the figure H.



22 Foure Square figures, are those which are bounded with four right lines as the figure I.



23 Many square figures, are those which are bounded with more right lines then 4. as K.



24 Of Triangles or three cornerd figures, there be sixe kindes, whereof the 1. is called Isoplurus, having three equall sides and three equal Angles as A.



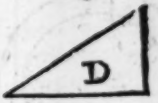
25. The second is called Isosceles, having but two equall sides & angles as B.



26 The third called scalenos having no side equal one with the other, but one shorter or longer then another, as C.



27 The fourth is called Orthogonius having one right angle as D.



28 The fift angle is called ampligonius because it hath one blunt angle as E.

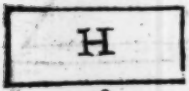


29 The sixt is called oxigonius, because it hath three sharpe angles, but not equall sides as F.





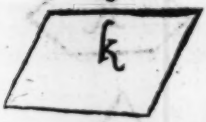
30 Of four square figures there is one iust foure square, hauing foure equal sides, and is right angled as G.



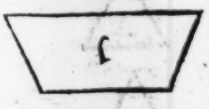
31. Another is called a long Square which is right angled, but not hauing four equall sides as H.



32 There is another called rombus, that is to say a Turbut in shape like to a Diamant which hath foure equal sides, but is not right angled as I.

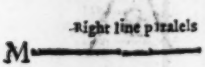


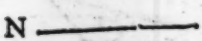
33. There is another called romboides, which though it hath sides and angles one right against another, yet hath it neither foure equall sides, nor yet is right angled as K.



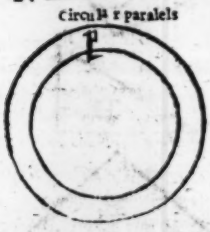
34. All other kindes of foure squares are called trapezia, as L. and such like.

Right line paralels





Circular paralels



35. Paralels are two right lines equally distant one from another, which beeing drawne forth infinitely, would neuer touch or meete one another in any parte, as the two lines M.N. And though the lines bee circular, yet if they be equally distant in all places one from another, they are also called paralels, as the figure P. sheweth, yea though the lines be winding in and out as Serpentes, if they be equally distant in all places one from another, they are paralels as wel as they were right lines as the figure Q. sheweth.

serpentine paralels



The order and Contents of this Treatise touching the first principles of Cosmography, and specially of the Spheare.

HAuing set down the exposition of certaine termes of Geometry, for the better vnderstanding of this Treatise, I do first define what Cosmography is and therewith doe briefly shewe what Sciences it comprehendeth, and who were first inuentors thereof: That done, because the Spheare doth represent the shape of the whole worlde, I doe define what a Spheare is, and then I doe diuide the worlde into two essentiall partes, that is the Celestiall and Elementall part, according to which two partes, I do also diuide this Treatise into two Bookes, the first whereof treateth of the Celestiall part, and the second of the Elementall part of the worlde with what order the Chapters of each booke hereafter following doe plainely shew.

The Chapters and Contents of the first booke.

OF Cosmography, what it is, and what kind of Sciences it comprehendeth, and who were first inuentors thereof. Chap. 1.

The definition of a Spheare, and of the vnitie, roundnesse and capacitie of the worlde, also of the Pole and Axletree thereof. Chap. 2.

Of the diuisiō of the world, and of the two Essential parts thereof, and what thinges ech part containeth, chap. 3.

A figure of the whole world wherein are set foorth the 2. Essentiall partes before mentioned, that is to say, the eleuen heauens and the foure Elements.

A demonstration to proone the pluralitie of the heauens cap. 4

Of the higheſt Spheare or heauen, called the Imperiall heauen. Chap. 5,

Of the tenth Spheare or heauen called in Latine *Primũ mobile*, that is the firſt moueable, & what motion it hath, chap. 6.

Of the ninth heauen, what motions & names it hath, & whither there be any waters aboue the firmament or not. chap 7.

Of the eight heauen what motions it hath, and what circles are imagined by the Aſtronomers to be in that heauen and to what vſe and purpoſe they ſerue: Alſo in what time euery one of the ſeuen Planets maketh his reuolution, & of what thicknes their Spheares be chap. 8

Of the circles whereof a materiall Spheare conſiſteth and of there diuers diuiſions chap. 9,

Of the Equinoctiall line, why it is ſo called, and of the diuers vſes thereof, chap, 10.

A figure ſhewing the Equinoctiall line, the two Poles, and the Axletree of the world.

Of the Zodiaque, why it is ſo called, and of the 12. ſignes therein contained. Alſo of the Latitude, Longitude and declination thereof, chapter 11.

How much the Zodiaque declineth from the equinoctiall towardes either of the poles, and of the greateſt declination of the ſunne, what it is at this preſent, and what it hath beene in times paſt. chap 12.

How to know the quantitie of the ſunnes declination bee it Northward or Southward, euery day throughout the yeare aſwell by a Table as by helpe of a materiall Spheare or globe, chap, 13.

An Inſtrument to knowe thereby in what ſigne or degree the Sunne is euery day throught the yeare.

A Table ſhewing the declination of the Sunne euery day throughout the yeare lately calculated.

Vpon what Poles the Zodiaque turneth about, alſo of the Ecliptique line and of the diuers vſes there of, chap. 14.

Of the Eclipſes both Solar & Lunar, & of the head & taile of the Dragon with certaine figures ſhewing the ſame cap. 15.

Of the two Colures, why they are ſo named, and whereto they ſerue: Alſo of the foure Cardinal points, that is, the two Equi-

Equinoctiall & the two Solſtitiall points, and of the entrance of the ſunne into any of thoſe pointes, or into any other ſigne Chap 16

Of the Horizon both right and oblique, making thereby three kinds of Spheares, that is, the right, the paralel, and the oblique Spheare. Chap. 17

A figure ſhewing the latitude of any place to be equal vnto the eleuation of the Pole.

Of the meridian, and of the vſes thereof. Chap. 18.

Of the verticall circle and vſes thereof, whereof no mention is commonly made by thoſe that write of the Spheare. c. 19

Of the foure leſſer circles, that is to ſay, the circle artique, the circle antartique, the Tropique of Cancer, and the Tropique of Capricorne, and alſo of the fiue Zones, that is to ſay, two cold, two temperate, and one extreamely hoat, Chap. 20.

A figure ſhewing the fiue foreſaid Zones.

A table ſhewing how many minutes are requiſite to make one degree in euery leſſer circle anſwerable to one degree of the equinoctial.

Of the ſtars and celeſtiall bodies contained in the firmament, and firſt of their ſubſtance. Chap, 22,

Of the mouing and ſhape of the ſtarres. Chap. 23

Of the number of the ſtarres, and of their magnitude and greatnes. and into how many Images they are diuided, & how many ſtarres euery Image containeth. Chap. 23.

Of the xii Images or ſignes of the Zodiaque Chap. 24.

Of the xxi, Northerne Images, Chap, 25,

Of the 15, Southerne Images, Chap, 26,

Of the longitude of the fixed ſtarres, and of the proceſſion of the vernall equinoctiall point, and what it is, Chap, 27,

Of the longitude of the fixed ſtarres, Chap, 28,

Of the Declination of the fixed ſtarres, Chap, 29

Of the aſcention and diſcention, that is the riſing and ſetting of the ſtarres, aſwel according to the Aſtrononers, as according to the Poets, Cap, 30,

Of the Aſtronomicall aſcention and diſcention in general both right, meane, & oblique, & what a giuen arke is. Cap, 31.

Of

Of the right oblique and meane aſcention in particular, & of the chiefe cauſes of ſuch diuerſitie of aſcentiõs cap.32.

How to know the diuerſities of the aſcentions and diſcẽtions, aswell in the right as oblique Spheare.cap.33.

Of the aſcentional difference & vſes thereof.cap.34.

Of the three old poetical riſing & ſetting of the ſtars c.35.

Of time what it is, and into what parts it is diuided c.36.

Of the yeare, and of his diuers kindes, and of the diuerſe computations had thereof in diuers ages, & amongſt diuers Nations.chapter 37.

Of the ſunnes yeare called in Latine *annus ſolaris* and of the diuers kindes thereof, and firſt of the Tropicall yeare, both equall and vnequall.chap.38,

Of the Siderall yeare, and how much it cõtaineth cap 39.

Of the Politicall yeere, & diuers kindes therof.cap 40.

Of the Iulian yeare, why it is ſo called, and of the two kinds thereof, that is, the common yeare, and the biſſextile yeare, otherwiſe called the leape yeare.chapter.41.

Of the egiptiã yeare, & how many daies it cõtaineth c.42

How many Moones the Iewes yeare, and the Athenians yeare doe containe, chap 43.

Of the yeare Lunar, & of the kindes thereof, cap.44.

Of the diuers kinds of Monthes, and into what partes euerie Solar moneth is diuided according to the Romaines that is into Kalends, Nones, and Ides.cap.45.

Of the diuers kindes of monethes Lunar.cap.46.

Of a weeke.cap.47,

Of daies and nightes both natural and artificial, as wel in the right Spheare, as in the oblique Spheare, cap.48,

Two figures ſhewing the right and oblique Spheare, together with the arkes of the daies and nightes in each Spheare cap.49,

How to find out by the material ſphere or Globe, and by helpe of the aſcentionall difference before defined, the increaſe & decreaſe of euerie day throghout the year in euery ſeueral latitude, & at what houre the ſũ riſeth & ſetteth c.50

How

How to know by the material Spheare or Globe, in what part of the Horizon the ſunne riſeth and ſetteth euery day, and thereby the length of the day. Alſo how to know the meridian altitude of the ſunne euery day throughout the yeare & being at his meridian altitude, to know how farre diſtant he is from the Zenith euery day, chap. 51.

Of houres as well equall as vnequall, and into what partes they are diuided. chap. 52.

How and in what manner the Iewes doe diuide the artificiall day and night, each of them into foure quarters, chap. 53.

To know what Planet reigneth in euery houre of the day or night artificial, aſwell by help of a Table, as by a rule contained in one verſe. chap. 54.

Here endeth the Contents of the firſt booke.

The Chapters and contents of the ſecond *Booke, containing the Elementall part* of the world.

OF the Elementall part of the world. chap. 1.

Of the fire his nature and motion. chap. 2.

Of the Ayre, and into how many Regions it is diuided, chap. 3.

A figure ſhewing the three ſeuerall Regions of the aire.

Of the water, and whether it be round or not. chap. 4.

A figure ſhewing that the water is round,

Of the Earth, and whether it be in all parts round or not chap. 5.

Of the compaſſe of the earth, and of the diuerſitie of meſures, according to diuers countries. chap. 6.

Of the Longitude and Latitude of the Earth. chap. 7

A figure ſhewing the longitude and latitude of the world

How to know the Latitude of any place, as wel in the day as in the night. chap. 8.

How to know the true Longitude of any place. chap. 9.

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The first part of the Spheare.

Of Cosmographie, what it is, and what kinds of Sciences it comprehendeth, & who were first inuentors therof

Cap. 1

WHat is Cosmographie?

Cosmographie is the description of the whole world, that is to say, of heauen and earth, and all that is contained therein.

What special kindes of knowledge are comprehended vnder this Science.

These foure, Astronomie, Astrologie, Geographie and Chorographie.

What is Astronomie?

Astronomy is a Science, which considereth and describeth the magnitudes and motiones of the celestiall or superiour bodies.

Which cal you superiour bodies?

The Spheares or Heauens, and the Starres as well fixed as moueable, which we shall define hereafter in their proper places.

What is Astrologie?

It is a Science which by considering the motions, aspects, and influences of the starres, both foreseeth and prognosticate things to come.

What is Geographie?

It is a knowledge teaching to describe the whole earth, and all the places contained therein, whereby vniuersall Maps and Cardes of the earth and sea are made.

What is Chorographie?

It is the description of some particular place, as Region, Ile, Citie, or such like portiõ of the earth seuered by it selfe from ỳ rest.

Who

who were firſt inuentors of theſe Sciences?

Some ſay that Atlas was the firſt inuentor, whome the poets faine to beare vp the heauens with his ſhoulders, hauing his head placed in the North Pole, and his feete in the South Pole, and his right hand bearing the Eaſt part, and his left hand the Weaſt part of the world. Albeit that ſome apply this fiction of the Poets to an high mountaine in Affrica called Atlas, which for his greate height ſurmounting the cloudes, is ſaide to beare vp the ſkies. But ſome ſay that Adam our firſt Parent, was the firſt inuentor thereof: And ſome others affirme that Abraham was the firſt inuentor thereof. But whoſoeuer was the firſt inuentor, it well appeareth by Ptolomey his booke, called Almageſti, that he hath beene no ſmall furtherer thereof, and ſince his time in theſe latter dayes Georgius Purbacchius, Iohannes de Monte Regio, Copernicus, and diuers others haue learnedly treated thereof. But leauing to ſpeake of the firſt inuentors, or of the furtherers of theſe ſciences, I will ſpeake of the ſhape, capacitie, and vnitie of the world, and becauſe the ſhape thereof is likened to a rounde bodie called a Spheare, I will firſt define what a Spheare is.

The definition of a Spheare, and of the vnitie, roundneſſe, and capacitie of the worlde, alſo of the Poles and axletree thereof.

Cap. 1.

What is a Spheare?

A Spheare is a round body, contained or couered with one onely ſuperficies or vpper face, in the midſt of which body is a point or pricke, called the center, from which all right lines being drawne to any part of the ſuperficies or vpper face thereof, are of equall length, as you may perceiue by this figure heere following, the Centre whereof is marked with the letter A.

And



And this Spheare before defined representeth the frame of the whole world, containing all thinges, and is contained of none.

¶ How proove you that there is but one world?

By the authoritie of Aristotle, who sayeth, that if there were any other world out of this, then the earth of that world would moove towardes the Center of this world, which cannot be, vnlesse it should first ascend from his own Center to the superficies or vpperface of the same, which is against nature, for euery heauie thing naturally tendeth downeward, and euery light thing vpward, which common experience sheweth: for a stone being cast vpwardes, will fall downewardes, and the flame of a candle being turned downeward, will fly vpward.

How proue you the frame of the world to be round?

By three reasons, First by comparison, for the likenesse, which it hath with the chiefe Idea or shape of Gods minde, which hath neither beginning nor ending, & therefore is compared to a Circle. Secondly by aptnesse as well of mouing as of containing, for if it were not round of shape, it should not be so apt to turne about as it continually doth, nor to containe so much as it doth, for the round figure is of greatest capacitie and containeth most. Thirdly, necessitie prooueth it to be round, for if it were with Angles or corners, it should not be so apt to turne about, and in turning about, it should leaue voide and emptie places, which nature abhorreth, for no place by nature can be without a bodie, nor a bodie without a place.

Whereupon is this Spheare or great round frame turned?

Upon two most firme & immoueable hookes called in Latine, Cardines mundi, and in Greeke Poli, deriued of the verbe Polo, which is as much to say, as to turne, for as a doore turneth vpon his hookes, so the world turneth vpon his two Poles, whereof the one is fixed in the North, and the other in the South, & the North Pole is called in Latine Polus arcticus, and the South Pole is called Antarcticus, through which Poles from the one to the other passeth a right imaginatiue line called of the Astronomers

the Axletree of the world, about the which the world continually turneth like a Cartwheele, which you may see liuely expressed in a materiall Spheare made for the purpose, for in Plano it cannot be so well described.

Of the diuision of the world, and of the two essentiall parts thereof, and what things ech ~~part~~ containeth.

Cap. 3.

HOw is the world diuided?

Most writers doe make a twofold diuision thereof, that is according to substance, and according to accidents, which accidents, because they are none other thing, but points, lines, and Circles, and so incident and necessarily belonging (by position though not by nature) to the substantiall parts, as the one can not be described without the other, neither the subiect without the accidents, nor the accidents without their subiect, I will therefore make but one diuision of the world, diuiding the same into two essentiall parts, that is, the celestiall part, and the Elementall part, in the description of which parts, it shall also plainely appeare what those lines and Circles be, & to what end they serue.

VVhat doth the celestiall part containe?

The eleuen Heauens and Spheares.

Make you no difference betwixt these Spheares, and the great Spheare which you last defined to be couered with one superficies or vpperface.

Yes verily, for these haue two superficies or vpper faces, that is, the Conuexe and Concaue.

VVhich call you Conuexe and which Concaue?

The Conuexe is the outermost vpperface of any thing that is round, and therewith hollow, as of an ouen or vault, and the Concaue is the innermost or hollow superficies of the said ouen or vault, or of any such like round body hauing concauitie or hollownesse.

Which

VVhich be those eleuen Spheares, or Heauens, whereof you did last speake?

In ascending orderly vpwardes from the Elements they bee these, The first is the Sphere of the Moone, The second the Sphere of Mercury, The third the Sphere of Venus, The fourth the Sphere of the Sunne, The fift the Sphere of Mars, The sixt the Sphere of Iupiter, The seauenth the Sphere of Saturne, The eight the Sphere of the fixed Starres, commonly called the firmament. The ninth is called the second moueable or Christall heauen, The tenth is called the first moueable, and the eleuenth is called the Imperiall heauen, where God and his Angels are said to dwell.

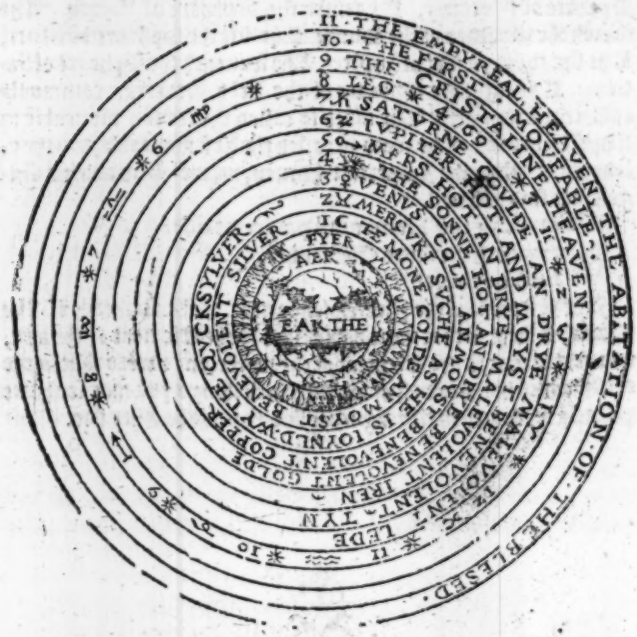
VVhat doth the Elementall part containe?

It containeth the foure Elements.

VVhich be those?

The Element of the fire, which is next to the Sphere of the Moone, & next to that more downward is the Element of the aire, and next to that is the Element of the water, and next to that is the earth, which is the lowest of all. All which things you may see heere plainely set forth in this figure following on the other side.

A figure of the whole world, wherein are set forth the two essentiall Parts before mentioned, that is to say, the eleuen heauens and the foure Elements.



A demonstration to proue the pluralitie of the heauens.

Cap. 4.

HOw is it to be proued that there is such multiplicitie of heauens, sith to the eye it seemeth one whole bodie?

If there were not diuers heauens and diuers motions, there shoulde neither bee generation nor corruption of any thing, for all things then should bee as one, and euer

euer in one estate, but besides that reason men haue found out by experience in obseruing the diuers rising and setting of diuerse wandring starres called the Planets, that euery such Planet hath a seuerall Spheare or heauen by it selfe, for otherwise they should continually kepe the places as the fixed starres doe, which doe moue altogether according to the moouing of the viii. heauen wherein they are placed.

I graunt that there may be diuerse heauens or Spheares. But how prooue you that there be tenne moueable heauens, besides the imperiall heauen before mentioned, and specially sith of the olde writers, some affirme that there be but nine, and some haue said that there be no more then eight?

The later writers haue found by good obseruation (as they say) that the firmament or eight heauen hath three seuerall motions wherewith it is moued and turned about, which could not be, vnlesse there were two moueable heauens higher then that, as shall be declared when we come to shew the threefold motion of the said eight heauen, for here I minde briefly to describe vnto you all the heauens, beginning at the highest, and so proceede to the lowest.

Of the highest Spheare or Heauen, called the imperiall heauen.

Cap. 5.

THe imperiall heauen (as our auncient Diuines affirme) is immooueable, and being created by God the first day that he began the first creation of the world, was by him immediately replenished with his ministers the holy Angels, and this heauen being the foundation of the world, is most fine and pure in substance, most round of shape, most great in quantitie most cleare in qualitie, and most high in place, where God and his Angels are said to dwell.

Of the tenth Spheare or heauen, called in Latine, *primum mobile*, that is, the first moueable, and what motion it hath.

Cap. 6.

THis heauen is also of a most pure and cleare substance, and without starres, and it continually moueth with an equall gate from East to West, making his reuolution in 24. houres, which kind of mouing is otherwise called the diurnall or dayly mooning, and by reason of the swiftnesse thereof, it violently carieth and turneth about all the other heauens that are beneath it from East to West, in the selfe same space of 24. houres, whether they will or not, so as they are forced to make their owne proper reuolutions, which is contrary from West to East euery one in longer or shorter time, according as they be far or neare placed to the same: yet some writers doe not admit any violence in the heauens, but that euery heauen hath his proper and naturall mooning without any violence.

I do not well vnderstand by what reason the first moueable should haue such force ouer the rest.

For your better vnderstanding how this may be, suppose that you turne with your hand frō East to West a Grindstone, or some other turning whéle whereon is placed a Fly or some other crēping worme, which commeth towards you from West to East, and you shall easily conceiue that by your swift turning of the whéle, you shall turne about the said Fly or Worme many times contrarie to her owne course, whether she will or not, before she can get about the said stone or whéle.

That is true, proceed therefore to the rest, and tell the nature and mooning of the ninth heauen.

Of the ninth heauen, what motions and names it hath, and whether there be any waters about the firmament or not.

Cap. 7.

THe ninth heauen is also cleare of substance, and without starres, hauing two mooings, the one from East to West vpon the poles of the world, according to the dayly mooning of the first moueable, and the other from

from West to East vpon his owne poles, according to the succession of the signes of the Zodiaque, which is in the first moueable, turning so slowly about as it maketh but one degrée in 100 yeares, and accomplisheth his full reuolution in 36000. yeares, or as Alfonsus saith in 49000 yeares.

Is there then in the first moueable any Zodiaque, that is to say, a broad Circle carrying the 12. signes and yet no starres?

Yea though there bee no starres, yet many superstitious fooles doe imagin that there be diuers Characters and lineaments not to be seene, but with a most sharpe and subtill sight, by vertue of which Characters (fained constellations) they imagine that they can worke wonders and strange effects, inough to deceiue themselues and others too.

What is the cause that the ninth heauē is so long in making his proper reuolution,

Because as I saide euen now, this heauen is placed next to the first moueable, which carieth him about cōtrary to his owne course with such violence as he cannot make his owne proper reuolution so soone as the other heauens which are placed further off.

If the ninth heauen be so long in making his course, it will neuer be compleat whilst the world lasteth, for the whole age of the world according to some, is but 6000. yeares?

Yet Plato was of an other opinion, and therefore this reuolution was called magnus annus Platonis, that is to say, the great yeare of Plato, because hee affirmed that when this reuolution was once complet, all things should be in the same estate wherein they were at the first, and that he should then stand reading to his Schollers in the selfe same chaire wherein he stood at that present, which fond opinion S. Augustine confuteth in his 12. Booke de Ciuitate Dei, speaking in this manner, God forbid (saith he) that we should credit these things, for Christ dyed once for our sinnes, and being risen againe from the dead, he is no more to die, neither can death haue any more power ouer him, by vertue of whose resurrection, we also that beleeue shall rise againe, and dwell with God for euer.

By what name is this ninth heauen called?

Some do call it the Christalline heauen, because of the clearenes thereof, and some the watrie heauen, because the Scripture

affirmeth that there be waters aboue the firmament as wee reade in Gen. cap. 1. Let the firmament be made, and diuide the waters from waters. Againe we read in the Psalmes, All ye waters that be aboue the firmament, bleſſe ye the Lord.

The naturall Philoſophers allow no waters to dwell aboue the firmament.

That is true, yet notwithſtanding if the holy Scriptures doe manifeſtly affirme, that there be waters aboue the firmament, it behoueth a Chriſtian to beleeue it: but queſtion perhaps may be moued, what manner of waters they are that are aboue ỹ firmament, whether ſuch as breed raine, or whether they are only to be referred to the Chriſtalline heauen, becauſe it is of a watrie ſubſtance, and therefore of ſome is called the watry heauen, affirming it to be placed next to the primum mobile, or firſt moueable, to the intent that with the coldneſſe thereof it might aſſwage & repreſſe the extreame heat of the ſame primũ mobile, which otherwiſe (as ſome affirme) with his ſwift & violent mooving, would ſet al the heauens on fire, and yet no raine is bred therein, for the great raine that drowned the world in Noahs time, did not fall from aboue the firmament, but from the Aire, which in the holy Scriptures is many times ſignified by this Latine word Cœlum, that is to ſay, Heauen, as when the Scripture ſaith, the flood-gates of heauen were opened, is as much to ſay as the flood-gates of the Aire were opened, &c. but leauing this queſtion, let vs proceede to the eight heauen.

Of the eight heauen, what motions it hath, and what circles are imagined by the aſtronomers to be in that heauen, and to what vſe and purpoſe they ſerue: Alſo in what time euery one of the ſeuen Planets maketh his reuolution, & of what thicknes their Spheares be.

Cap. 8.

THe eight heauen otherwiſe called the firmament, is a moſt glorious heauen, adorned with all the fixed ſtarres.

Why are they called fixed?

Becauſe they are faſtned in this heauen, like knots in a knottye board, hauing no mooving of them

themselues, but are mooued according to the mooning of this eight Spheare or heauen wherein they are fixed.

How many fold is the mooning of this heauen?

The mooning of this heauen (as hath beene said before) is threefold, for first it turneth about euery day from East to West in 24. houres, according to the mooning of the first moueable, otherwise called the diurnall mooning. Secondly it mooueth from West to East, according to the mouing of the ninth heauen, which maketh but one degree in 100. peares, and this mouing is called motus augium Stellarum fixarum.

What are Auges?

They be certaine imagined points in the heauen, notifying the furthest distance of any Orbe or Spheare from the Center of the world: Thirdly it mooueth sometime towards the South, and sometime towards the North, by vertue of his owne proper mooning, called in Latine motus trepidationis, that is to say, the trembling mouing, whereby it is mooued vpon two little Circles the poles whereof are in the beginning of that Aries and that Libra which are imagined to be in the ninth heauen, the Semidiameter of which little Circles is 4. degrees, 1′8. and 4″3. & maketh his whole reuolution in 7000. peares, and this mouing is otherwise called motus accessus & recessus, that is to say, the mouing of approching and retiring, and is onely proper to the 8. Sphere: for euery naturall bodie by order of nature, can haue but one proper mooning, and by reason of this mooning, the fixed starres bee not alwaies equally distant from the immooueable poles of the tenth Sphere, nor alwaies vnder ỹ Eclyptique of the said tenth Sphere, but often times cleane without it. Nor the fixed starres are inequall times equally distant from the beginning of that Aries & Libra, which are imagined to bee in the tenth heauen, but they seeme to moue sometime towards the East, and sometimes towards the West, now more swiftly, and now more slowly. For Ptolemy in his time found them to be mooued in 100. peares one degree. And the latter obseruers haue found them when they bee in their swift motion to be mooued one degree in 36. peares, all which, three moonings are easie (as some affirme) to be demonstrated by one instrument made of purpose, shewing euery seueral mooning of this heauen by it selfe, but such demonstrations as some others thinke bee

not

not altogether necessarie conclusions: for it may be that the dayly mooving is common to the whole frame, and that the mouing of the Auges of the fixed starres, is proper to the eight Sphere hauing some other mouer, and the like obiection may bee made touching the trembling mooving, called motus trepidationis. But now you haue to vnderstande that for the better describing, deuiding, and measuring of this heauen, and all the apparances thereof, the Astronomers with the Pensill of imagination, or rather of most necessarie inuention, doe (as it were) trace the same with certaine Circles both greater and lesser, whereof wee shall speake as soone as we haue briefely shewed the mouing of the rest of the heauens, contained in the celestiall part of the world, in such order as they follow one another. For next to the firmament is the heauen of Saturne, which maketh his reuolution from West to East in 30. yeares, next to him is the heauen of Iupiter, who maketh his reuolution from West to East in 12. yeares, next to him is the heauen of Mars, which maketh his reuolution also from West to East in 2. yeeres, next to him is the heauen of the Sunne which maketh his reuolution from West to East in 365. dayes, and 6. houres lacking certaine minutes, next to him is the heauen of Venus, which maketh her reuolution from West to East in like time as doth the Sunne, next to Venus is the heauen of Mercury, which maketh his reuolution from West to East in the like space that Venus doth: And next to Mercury is the heauen of the Moone, which maketh her reuolution from West to East in 28. dayes and certaine minutes. Thus hauing briefely described the eleuen heauens, I will now treat of the Circles that are imagined (as I said before) by the Astronomers to be in the eight heauen or firmament, to the intent that the measures and distances of the starres, images, signes, and other apparances therein contained, might be the better demonstrated.

Before you deale with these Circles, I would gladly vnderstand some reason why all these seuerall heauens seeme to the eye but as one entire body.

That is because they are all cleare and transparent like fine birall glasse, or Christall, through the which the light doth easily pearce, though there were neuer so many coates of such cleare substance, couering one another like the skales of an Onion, for

so

so the heauens doe couer and enclose one another, and euerylone is of an exceeding great thicknesse.

Why how thicke is euery such heauen?

The heauen of the Moone ——— 105/222. $\frac{3}{11}$ miles.
containeth in thicknesse.
The heauen of Mercury containeth ——— 253372 $\frac{3}{11}$
The heauen of Venus, ——— 3274494 $\frac{6}{11}$
The heauen of Sol, ——— 343996 $\frac{4}{11}$
The heauen of Mars, ——— 26/308/800.
The heauen of Iupiter, ——— 1899654 $\frac{6}{11}$
The heauen of Saturne, ——— 19604454 $\frac{6}{11}$

What neede haue the heauens to be so thicke?

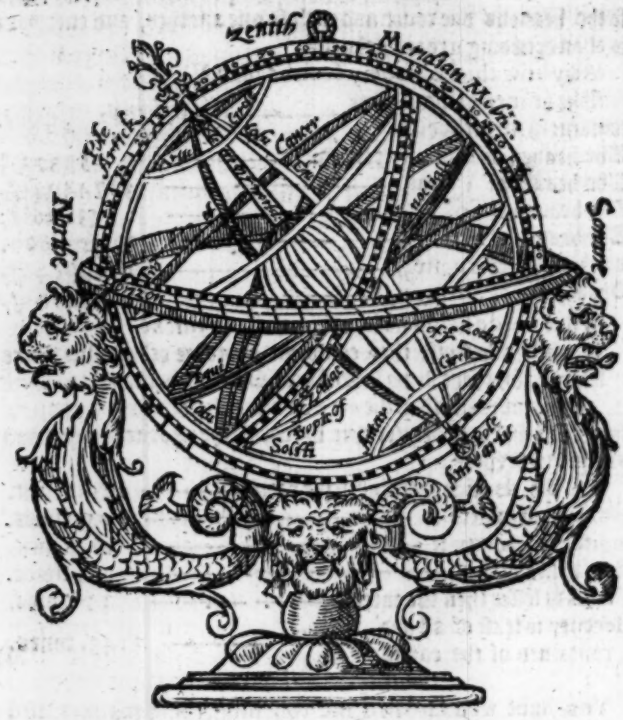
Because otherwise they could not containe eche one his starre or starres, for there is no fixed starre so little, but that it is fare greater in compasse then the earth, neither is there any wandring starre, but that it is bigger then the earth, the Moone, Venus and Mercury excepted.

For the Sunne containeth the earth ——— 166. times.
Saturne containeth it ——— 95. times.
Iupiter containeth it ——— 91. times.
Mars containeth it ——— 2. times.
Venus is lesser then the earth ——— 39. times.
Mercury is least of all and
is contained of the earth, ——— 3143. times.

You haue well satisfied me touching these matters, and therefore now proceede with the Circles if you thinke so good.

Before that I describe vnto you the Circles whereof a Sphere is made, or declare the vses thereof: I thinke it not amisse here to set downe the shape of a Spheare, together with the names of euery Circle written vpon the same, to the intent that you may be acquainted with all the partes of a Spheare before you come to vse the same: which shape or figure was first drawne by Master Blagraue, and is set downe in his booke called the Mathematicall Iewell.

Of



Of the Circles whereof a materiall Spheare conſiſteth, and of their diuers diuiſions.

Cap. 9.

OF Circles which are imagined to be in the firmament, and whereof a Spheare repreſenting the ſhape of the world is commonly made, be in all 10. that is to ſay, the Equinoctiall, the Zodiaque, the two Colures, the Horizon, the Meridian, the two Tropiques and the two polar Circles, of which Circles ſome be greater and ſome leſſer.

Which

Which call you greater and which lesser?

Those are called the greater Circles, which passing through the Center or midst of the firmament, doe diuide the whole circuit thereof in two equall partes, and of such Circles there bee sixe, that is to say, the Equinoctiall, the Zodiaque, the Colure of the Solstices, the Colure of the Equinoxes, the Horizon, and the Meridian. The lesser Circles ar the foure last mentioned, that is, the two Tropiques, and the two polar Circles, which are called lesser, because they doe not diuide the world into two equall parts, but into vnequall portions.

What other diuisions doe the Astronomers make of the said Circles?

Diuerse, for some are saide to be paralels, some right, some oblique, some moueable, and some immoueable.

Which are said to be paarlels?

The two polar Circles, and the two tropiques, and the Equinoctiall which is in the very midst of them all.

Which are saide to be right and which oblique?

The right be the two Colures, the right Horizon, and the Meridian, because they cut the Spheare or globe with right Angles: And the oblique are these two, that is, the Zodiaque, and the oblique Horizon, which are saide to bee oblique, because they cut the Spheare or globe with oblique Angles.

Which are said to be moueable, and which immoueable?

The moueable are these, the Equinoctiall, the Zodiaque, the two Tropiques, & the 2 polar Circles which are saide to be moueable, because they continually moue with the firmament, & are like in all places. And these also hauing respect to a material Spheare, are said to be intrinsicall or inward. The immoueable are these 2. that is, the Horizon, & the Meridian, which are said to be immoueable because in the turning of the Spheare they remaine vnmooued, for though wee change both Meridian and Horizon by going from one habitation to another vpon the earth, yet euery place hath still his owne Meridian and Horizon, which doe remaine immoueable, and these two Circles hauing respect to a materiall Spheare, are said to be extrinsicall or outward, because they do inclose on the outside all the other Circles of a materiall Spheare. Thus hauing sette downe the diuisions of the saide Circles,

I will

I will now describe them all in order, and shew to what vses they serue, beginning first with the great Circles, and so proceed to the lesser, and first I will speake of the Equinoctiall.

Of the Equinoctiall line, why it is so called, and of the diuers vses thereof.

Cap. 10.



What is the Equinoctiall?

The Equinoctiall is a great Circle, which being in euerie part equally distant from the two poles of the world, diuideth the Spheare in the very midst thereof, into two equall parts, and therefore it is called of some, the gyrdle of the world.

Wherefore is it called by the name of the Equinoctiall?

Because, that when the Sunne toucheth this Circle, which is twice in the yeare, the day and night is of equall length throughout the world.

At what time of the yeare is it Equinox?

In the spring of the yeare, about the 11. day of March, when as the Sunne entreth into the first degree of Aries, and againe in Autumne about the 13. of September when as the Sunne entreth into the first degree of Libra. And by reason that this Circle deuideth the world in the verie midst, those that dwell right vnder it, are saide to haue no Latitude either Northward or Southward, to whom the dayes and nights are alwaies equall. But if they dwell any thing distant from the Equinoctiall, towards any of the poles, then they are saide to haue Latitude more or lesse, eyther Southward or Northward, as shall be declared hereafter more at large, when wee come to treat of the Longitude and Latitude of the earth, both which are to bee knowne by helpe of the Equinoctiall.

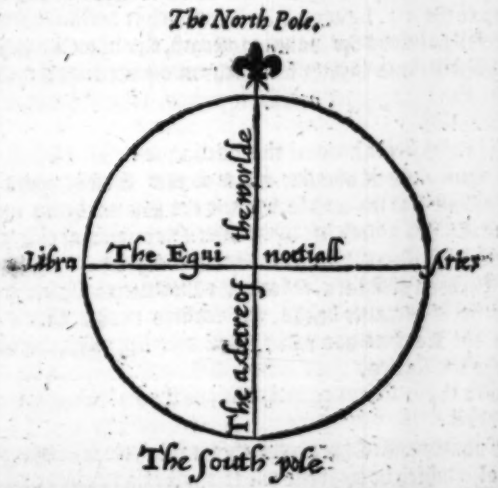
To what other vses serueth this Circle?

This Circle hath many most necessarie vses, for first it sheweth the daily mooving of the first moueable, which maketh his reuo-

lution

lution in 24. houres, which houres are equall, and are to be measured by the degrees of the Equinoctiall, by allowing 15. degrees thereof to an houre. And therefore the degrees of the Equinoctiall are commonly called in Latine of the Astronomers tempora, of which degrees it containeth 360. which being diuided by 15. doe make 24. houres, which is a naturall day, containing both day & night: Moreouer it sheweth the declination of the fixed starres and their right ascentions, whereof we shall speake when we come to treate of the starres, and by his equall motion, all the inequalities of the Zodiaque, and of all the signes contained therein, are measured: And to be short, this Circle hath many other good vses not to be declared vntill you haue some knowledge of the rest of the other Circles hereafter described.

A figure shewing the Equinoctiall line, the two Poles and Axletree of the world.



Of the Zodiaque why it is so called, and of the 12. signes therein contained: also of the Latitude, Longitude, and declination thereof.

Chap.

Cap. 11.

WHat is the Zodiaque?

It is a broad, oblique, or slope Circle, hauing a circular line in the midst thereof, called the Ecliptique line, and deuideth the Spheare into two equall partes, by crossing the Equinoctiall with oblique Angles in two points, that is in the beginning of Aries, and in the beginning of Libra, so as the one halfe of this broad Circle declineth towardes the North, and the other halfe towardes the South: in which Circle many thinges are to be considered, first the name, then what breadth it hath, and why it hath such breadth, and into what parts it is deuided aswell touching the breadth or Latitude, as circuit or Longitude thereof, also into how many parts the firmament is deuided by the spaces described in the Zodiaque, and appointed to the 12. signes. Also how much it declineth from the Equinoctiall towards the South or North, and vpon what Poles it turneth about, and why the line in the midst is called the Ecliptique line, and many other necessarie points, which I minde here briefely to touch.

Why is this Circle named the Zodiaque?

It is named the Zodiaque either of this Greeke word zoe, which is as much to say as life, because the Sunne being mooued vnder this Circle, giueth life to the inferiour bodies, or else of this Greeke word Zodion, which is as much to say as a beast, because that 12. Images of Starres, otherwise called the 12. signes, named by the name of certaine beasts, are formed in this Circle: and therefore the Latines doe call this Circle Signifer, because it beareth the 12. signes.

How are these signes called, and with what Characters are they marked?

Their names and Characters this table here following doth shew, & also which be opposite one to another, as Aries to Libra, Taurus to Scorpio, and so forth.

The sixe Northerne signes.		The sixe Southerne signes.	
Aries	♈	Libra	♎
Taurus	♉	Scorpio	♏
Gemini	♊	Sagittarius	♐
Cancer	♋	Capricornus	♑
Leo	♌	Aquarius	♒
Virgo	♍	Pisces	♓

Of which signes the first sixe on the left hand are called the Northerne signes, because they are contained in that halfe of the Zodiaque, which declineth towards the North. And the other sixe on the right hand being right opposite to the first 6. are called the Southerne signes, because they are contained in the other halfe of the Zodiaque, declining towards the South: And against euery signe is set his proper Character.

What diuisions doe Astronomers make of the 12. signes.

Diuerse, as followeth: for some are said to be ascendent, and some descendent.

Ascendent are those that rise from the South towards our Zenith, tending Northward, which be these, Capricornus, Aquarius, Pisces, Aries, Taurus, and Gemini.

The descendent are these, Cancer, Leo, Virgo, Libra, Scorpio, and Sagittarius.

Againe some are said to be vernall, as Aries, Taurus, and Gemini.

Some Æstiuall as Cancer, Leo, Virgo,

Some Autumnall as Libra, Scorpio, and Sagittarius.

And some Hiemall or Brumall, as Capricornus, Aquarius, and Pisces, signifying the foure seasons of the yeare, that is to say, the Spring, Sommer, Autumne, and Winter.

And some doe make diuerse other diuisions, which because they appertaine to Astrologie rather then to the Treatise of a Sphear, I willingly omit them.

Now tell what breadth the Zodiaque hath, and why it is imagined to haue such breadth?

It hath (according to the ancient writers) 12. degrees in breadth, that is to say, 6. degrees on the one side of the Ecliptique line, & 6. degrees on the other side of the Ecliptique line, but according to

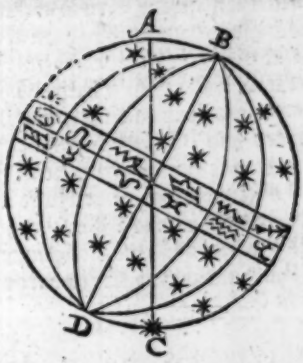
the moderne writers, it hath 16. degrees in breadth, that is, eight degrees on ech side of the Ecliptique line, which breadth was necessarily imagined, first to the intent that by the measures and degrees thereof it might be knowne, how much the Planets (otherwise called the wandring starres, whose course is to passe continually vnder this broad Circle) doe wander at any time on either side of the Ecliptique line, for they all wander, but some more, some lesse, the Sunne onely excepted, which neuer swarueth from that line, but alwaies goeth right vnder the same, and therefore the said line is called of some writers the way of the Sunne: And secondly it hath such breadth, to the intent it may containe within the same, the 12. signes aforesaid, by meanes of which signes the whole circuit or longitude of the said Circle is deuided into 12. equall parts, and euery such part is deuided into 30. degrees, and euery degree into 60. minutes, and euery minute into 60. seconds, &c. so as the whole Longitude thereof containeth 360. degrees, according vnto which diuision, all the rest of the Circles both greater and lesser described in the Spheare, are made to containe the like number of degrees, and euery halfe Circle to containe 180. degrees, and euery quarter of a Circle to containe 90. degrees, and by this diuision as well of the breadth, as of the length of the Zodiaque, it appeareth that euery one of the 12. Signes hath 30. degrees in length, and 12. degrees in breadth, and thereof the Planets, Starres, and all other Celestiall bodies are said to haue both Longitude and Latitude, the Sunne onely excepted.

How is such Longitude and Latitude to be vnderstood?

The Longitude of any Planet or Starre is to be counted in the Ecliptique line containing in circuit 360. degrees, reckoning from the first point of Aries, and so to Taurus, Gemini, and Cancer, and so forth according to the succession of the signe, vntill you come againe vnto the first point of Aries, at which point such Longitude both endeth and beginneth. The Latitude is counted from ỳ said Ecliptique line towards any of the Poles of the Zodiaque. And hereof looke how many degrees any fixed starre or Planet is distant from the Ecliptique line towards any of the said Poles, so much Latitude it is said to haue either Northerne or Southerne: moreouer, by this diuision of the signes the whole firmament is

deuided

deuided into 12. parts by reason of 6. Circles called the circles of position, imagined to passe through the poles of the Zodiaque, and also through ỳ beginning of euery signe, whereby we know vnder what signe euery star is situated though it be cleane out of the Zodiaque as this figure here plainely sheweth, marked with these letters A.B.C.D. A signifieth the North pole of the worlde, B. the North pole of the Zodiaque, C. the South pole of ỳ worlde, D. the South pole of the Zodiaque.



How much the Zodiaque declineth from the Equinoctiall towards either of the Poles, and of the greatest declination of the Sunne, what it is at this present, and what it hath beene in times past.

Cap. 12.

YOu haue to vnderstande that the Zodiaque or rather the Ecliptique line, decli-neth from the Equinoctiall towards eyther of the poles 23. degrees, 28. and that is saide in these dayes to be the greatest declination of the Sunne, which declination is two fold, that is Northerne and Southerne, for like as the Sunne entring into the first pointe of Aries, beginneth then to decline from the Equinoctiall Northward, to the quantitie of 23. degrees and 28. so entring into the first point of Libra he declineth againe from the Equinoctiall as much Southward. And note by the way that by reason of this slowe motion, when he is in the Northerne signes, he spendeth 7. dayes, and ½ of a daye more in making his North declination then in making his South

declination, because hee is then in his swift motion, and the time hath beene that he hath spent aboue ten dayes more in making his North declination, then in making his South declination: neither is the greatest declination of the Sunne in all ages of like quantitie. For in Ptolomies time it was 23. degrees, 51. and 2″0 euer since whose time it hath alwaies continually decreased vntill this present, so as now the greatest declination is no more but 23. degrees and 28. And Copernicus maketh the declination of the Sunne in respect of quantitie to bee twofold, that is, greatest and least, affirming the greatest to be 23. degrees and 52. and the least to be 23. degrees and 28. as it is now counted, the difference whereof is 24. and whilst the Ecliptique departeth from the Equinoctiall, and turneth againe towards the Equinoctiall, there doe run (as he saith) 3434. yeares.

How to know the quantitie of the Sunnes declination, bee it Northward or Southward, euery day throughout the yeare, as well by a Table as by helpe of the Spheare.

Cap. 13.

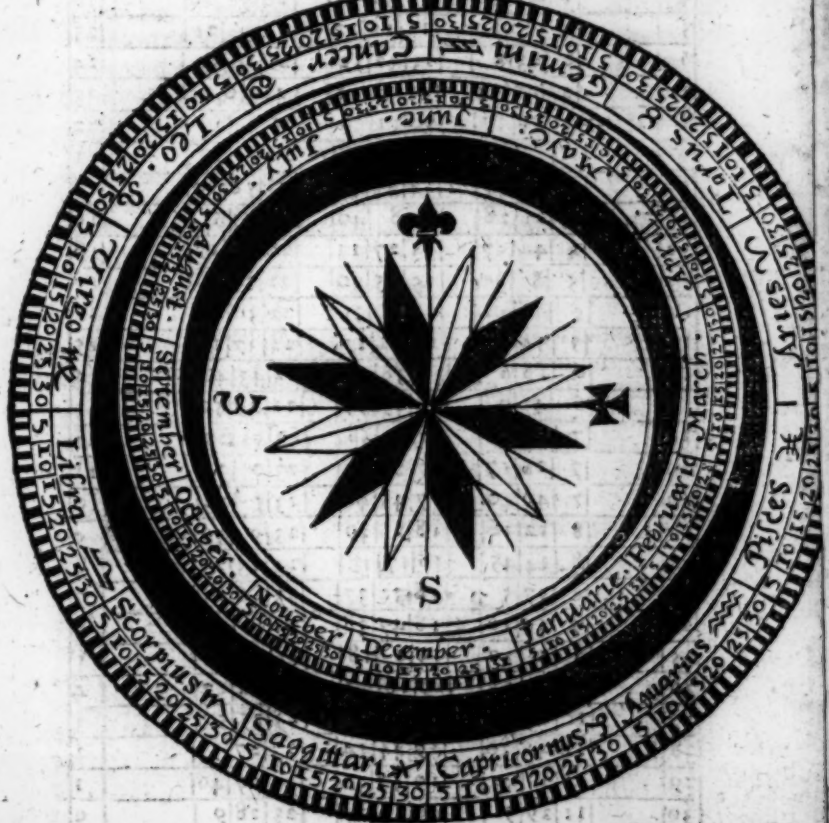
THis is chiefly to bee knowne by Tables calculated of purpose, which Tables most commonly are either made to aunswere euery day of the moneth, or else to the degree of the signe wherein the sunne is euery day, which kinde of Table is contained in lesser roome then the other, but to worke by such a Table, you must first knowe in what signe and degree the sunne is euery day.

How is that to be done?

It is to bee knowne most truely by the Ephemerides or such like Table calculated of purpose, shewing not onely the degree of the signe, but also the very minute wherein the Sunne is euerie day, and for want of such a Table, you may without consideration of the minutes, know it by such an instrument or figure as this following, which consisteth of diuerse Circles, whereof the outermost containeth the degrees of the 12. signes, together with the

the names of the said signes, and the next the daies of ech moneth, together with the na
of the said moneths. much like the backside of an Astrolabe, in the center or midst of w
instrument or figure is a thred, which if you lay vpon the day of the month which you s
it will straight direct you to the degree of the signe wherein the Sun is that day, as fo
ample, if you would know in what signe & degree the Sun is the 4. of May, then by d
ing the thred right vpon the said day ouer and beyond the outermost circle, you shall
that it will fall right vpon the 23. degree of Taurus.

An instrument to know thereby in what signe and degree the Sunne is euery day throughout the yeare.



Then hauing found the degree of the Sun you must resort therewith to this Table following, made for the declination of the Sun.

A Table shewing the declination of the Sun euery day throughout the yeare.

Degrees of the Signes.	♈ ♎ D	M	S	♉ ♍ D	M	S	♊ ♐ D	M	S	Degrees of the Signes.
1	0	23	53	11	50	6	20	22	57	25
2	0	47	46	12	10	56	20	35	7	28
3	1	11	39	12	31	34	20	46	55	27
4	1	35	30	12	51	59	20	58	20	26
5	1	59	20	13	12	12	21	9	21	25
6	2	23	8	13	32	12	21	19	59	24
7	2	46	54	13	5	158	21	30	13	23
8	3	10	37	14	11	30	21	40	3	22
9	3	34	18	14	30	48	21	49	29	21
10	3	57	54	14	49	51	21	58	29	20
11	4	21	28	15	8	40	22	7	6	19
12	4	44	57	15	27	13	22	15	17	18
13	5	8	22	15	45	30	22	23	3	17
14	5	31	42	16	3	32	22	30	24	16
15	5	54	57	16	21	17	22	37	19	15
16	6	18	6	16	38	44	22	43	48	14
17	6	41	9	16	55	55	22	49	50	13
18	7	4	6	17	12	48	22	55	27	12
19	7	26	57	17	29	23	23	0	38	11
20	7	49	40	17	45	40	23	5	22	10
21	8	12	16	18	1	39	23	9	39	9
22	8	34	45	18	17	18	23	13	29	8
23	8	57	5	18	32	37	23	16	53	7
24	9	16	16	18	47	38	23	19	50	6
25	9	41	19	19	2	18	23	22	19	5
26	10	3	12	19	16	37	23	24	22	4
27	10	24	56	19	30	36	23	25	57	3
28	10	46	30	19	44	14	23	27	5	2
29	11	7	53	19	57	30	23	27	46	1
30	11	29	5	20	10	25	23	28	9	0
D	D	M	S	D	M	S	D	M	S	D
	♑ ♓			♌ ♒			♋ ♑			

The description and vse of Table.

This Table consisteth of fiue collums, whereof the first on the left hand, and the last on the right hand doe containe the degrees of the 12. signes of the Zodiaque, counting from one to 30. And the three middle collums doe containe the degrees, minutes, and seconds of declination, ouer the head of which three middle collums are set downe the Characters of these 6. oppolite signes, Aries and Libra, Taurus and Scorpio, Gemini and Sagittarius, and at the foote of the said middle collums are set down the characters of the other 6. oppolit signes, that is, Virgo and Pisces, Leo and Aquarius, Cancer and Capricornus, for euery 2. oppolit signes, as well a boue as beneath, haue like declinatiō, the vse of which Table is thus: first hauing found out the degree of the Sun by the instrument before described, or rather by some true Ephemerides, you must seeke out the number of ỹ said degree, either in the first or last collum, according as the character of the signe is placed. For if the signe or character be a boue, then you must seek for ỹ said number in the first collum on the left hand, which numbers do descend from 1. to 30. but if the signe bee beneath, then you must finde it out in the outermost collum on the right hand, the numbers whereof doe ascend from 1. to 30. and the common Angle or square, standing right against the saide number will shew you the degree, minutes and seconds of the declination. As for example, hauing found by the former instrument that the 4. day of May the Sunne is in the 23. degree of Taurus, I seeing the Character of Taurus to stand a boue, do seek my foresaid number of 23. degrees in the first collum on the left hand, and in the common angle or square right against that number, and vnder the signe Taurus, I finde the declination of the Sun to be 18. degrees 32'. and 37''. But this Table cannot serue alwaies: yea rather such tables as are to bee renewed as our Astronomers say euery 30. yeares. Also you may know the daily declination of the Sun, by help of the material Sphere or globe: thus hauing set the Sphear at your Latitude, bring the degree of the signe wherein the Sun is that present day vnto the mouueable Meridian, and staying it there, marke whether it falleth on the South side or on the North side of the Equinoctiall:

for if it be in any of the Northern signes, it will fall on the North side of the Equinoctiall, and if it be in any of the Southern signes it will fal on the south side of the Equinoctiall, and by counting the degrees vppon the Meridian, contained betwixt the degree of the Sun and the Equinoctiall, you shall know what declination the Sun hath that day, as for example, in the latitude 52. in the yeare 1590. the fift day of May, I find the Sunne by the Ephemerides to be in the 23. degree and 48′. of Taurus, which point I bring to the moouable Meridian, and there staying it, I find that point to be distant from the Equinoctial Northward 18. degrees & certaine minutes, and so much of North declination I conclude the Sun to haue that day.

Vpon what Poles the Zodiaque turneth about, also of the Ecliptique line and of the diuers vses thereof.

Cap. 14.

The Zodiaque turneth about vpon his owne proper Poles from West to East, whereof the one being placed in the Colure of the Solstices towards the North, is distant from the pole Arctique 23. degrees, & 28′. and the other is placed in the said Colure towards the South, being of like distance from the pole Antarctique, whereof the Astronomers haue a generall rule, affirming that the distance of the two Poles of the world from the Poles of the Zodiaque, is alwaies equall to the greatest declination of the Sunne, which as hath beene said before, is 23. degrees and 28′. as you may plainely see by the Spheare. And note that these 2. Poles are otherwise called the Poles of the Ecliptique, for in considering the declination of the Sunne or of the Zodiaque from the Equinoctiall, you must haue respect onely to the Ecliptique line, which is in the midst of the Zodiaque, and not to any other parte of the Zodiaque. And as the Equinoctiall line sheweth the mouing of the first moueable, which is from East to West, so the Ecliptique line sheweth the mouing of the seconde moueable, which is from West to East, cleane contrary to the first moueable, the causes whereof haue beene before declared.

What other vses hath this line more than you haue already declared.

It hath diuers, for in this line or Circle are noted the degrees, wherewith any starre riseth or goeth downe, either rightly or obliquely, for all the apparances of the heauens are chiefely referred to this Circle. Againe by this circle the chiefest distinctions and parts of times, as yeares and moneths are knowne, and also the foure seasons, of the yeare, as Spring, Summer, Autumne, and Winter: Moreouer, the obliquitie of this circle vnder which the Sunne continually walketh, is cause that the dayes both naturall and artificiall are vnequall: Finally, this circle doth shew the places and times of the Eclipses both Solar and Lunar, from whence this line taketh his name, of which Eclipses we mind here briefly to treate.

Of the Eclipses both Solar and Lunar, and of the head and taile of the Dragon, with certaine figures shewing the same. Cap. 15.

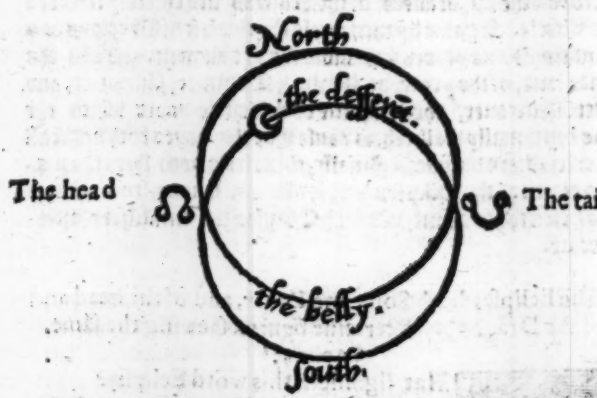


WHat signifieth this word Eclipsis?

It is as much to say, as to want light, and to be darkened or hidden from our sight, as when the Sun and Moone are both at one selfe time right vnder the Ecliptique line, the one of these two lights most commonly is Eclipsed and darkned: for there bee two Eclipses, the one of the Sunne, and the other of the Moone, but sith that neither the Eclipse of the Sun or of the Moone doth chance, but when they meet either in the head or taile of the Dragon, I thinke it good to shew first what is ment by the head and taile of the Dragon. The Dragon then signifieth none other thing but the intersection of 2. circles, that is to say, of the Ecliptique & of the Circle that carrieth the Moone, called her Defferent, cutting one another in 2. pointes, whereof that intersection which is westward, when as the Moone goeth towards the North, is called the head, and that which is Eastwards, when the Moone goeth towards the South is called the taile, marked with such Characters as you see in the figure following, and that parte towards the South is called of some the belly of the Dragon. And note that the Defferent of the Moone is at no time distant from the Ecliptique aboue 5. degrees at the most.

The

The figure of the Dragon.



This being presupposed, I will speake first of the Eclipse of the Moone, and then of the Sunne, both which may be Eclipsed either totally or in part.

When is the Moone said to be totally eclipsed?

When the Sunne and Moone are opposite one to the other diametrally, and the earth in the very midst betweene them both, for the body of the earth being thicke and not transparent, casting his shadow to that point which is opposite to the place of the Sunne, will not suffer the Moone to receiue any light from the Sun, from whome she alwaies borroweth her light.

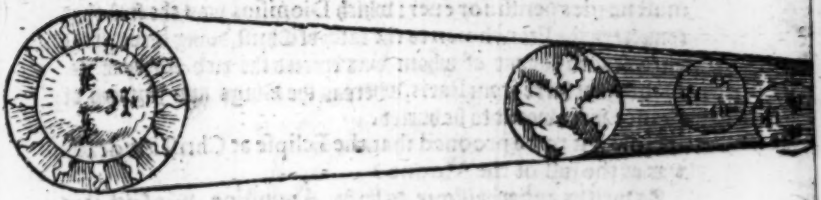
At what time is the Moone said to be diametrally opposite to the Sunne?

When a right line drawne from the center of the Sunne to the center of the Moone, passeth through the center of the earth: & note that euery time that she is at the full, she is opposite to the Sun, & yet the earth is not at euery such full diametrally betwixt her and the Sun, for then she should be eclipsed at euery full, which indeede cannot be but when she is either in the head or taile of the Dragon.

When is the *Moone* said to be eclipsed in part?

When the Sunne, the earth, and the Moone be met in one selfe Diametrall line, but the Moone is declining either on the one side or on the other, as you may plainely see by this figure following.

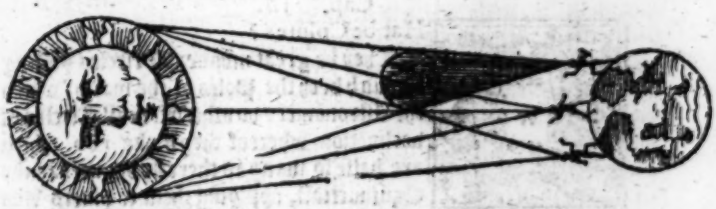
But



But note that the Eclipses of the Moone may be vniuersal, because the earth is farre bigger then the Moone, and thereby able to shadow her whole body.

When is the Sunne said to be eclipsed?

When the Moone is betwixt the Sunne and the Earth, which chanceth in a Coniunction, and yet not in euery coniunction, but when it falleth either in the head or taile of the Dragon, which may chance, as I said before, either totally or in part: totally I say, in respect of those parts of the earth whereon the shadow directly falleth. For sith the Moone is farre lesser than the Earth, she cannot shadow all the Earth, and therefore the Eclipse of the Sunne cannot be vniuersall, but yet to some parts of the Earth totally, and to some partly, and to other some nothing at all, as you may plainely see by this figure following.



Yet all the histories doe affirme that the Eclipse of the Sun was vniuersall at the death of Christ.

Yea, that was miraculous, and also it was then at the full of the Moone, which was also as miraculous: and therefore Dionisius a Senator of Athens, beholding that Eclipse cryed out, saying

ing these words, Either God this day suffereth or else the world must needes perish for euer: which Dionisius was the first that conuerted the Frenchmen to the faith of Christ, doing there great miracles, in honour of whom was erected the rich Abbey of S. Denise, not farre from Paris, whereas the Kings and Princes of France were woont to be buried.

How is it to be prooued that the Eclipse at Christ his death was at the full of the Moone?

As well by ancient history, as by S. Augustine, who saith that the Iewes were woont to keepe their feast of Passeouer (at which time Christ suffered) alway at the full of the Moone.

If the Sun and Moone be eclipsed but in part, how are such parts to be accounted?

By the parts of the Diameter of the bodies of those two Planets, for the Astronomers doe diuide the Diameter as well of the Sunne, as of the Moone into 12. and some into 24. parts, which they call points, and therefore are wont to say, that the Sunne or Moone are darkned or eclipsed 7. points, 8. points, 9. points, &c.

Of the two Colures, & why they are so named, and whereto they serue: also of the foure Cardinall points, that is, of the two Equinoctiall, and the two Solstitiall points, and of the entrance of the Sunne into any of those points, or into any other signe.

Cap. 16.

WHat be Colures?

They be great mooueable circles passing through both the Poles of the world, which the Astronomers do otherwise call Circles of declination, whereof they make 180. which are halfe so many as there be degrees in the Equinoctiall, applying them to diuers vses not needfull here to be rehearsed, for sith that there are but 2. Colures accustomably set downe in the Spheare, without the which a materiall Spheare cannot be made, I minde here therefore onely to treate of them.

Shew first what this name Colure signifieth.

This word Colure being compounded of Colos and Oura,

is

is as much to say, as vnperfect or maymed the taile being cut off, because none of those Circles are euer seene whole aboue our Horizon, but parte thereof, for some part is alwaies seene, and some part is alwaies hidden, as that part which is aboue the Horizon, and nigh vnto the Pole, is alwaies seene, because it neuer goeth downe vnder the Horizon: likewise that which is nigh vnto the South pole is alwaies hidden from vs, because it neuer riseth aboue our Horizon, as by turning the Spheare about, you may easily perceiue the same.

Which be those Colures that are cómonly set downe in the Spheare, and how are they named?

They are two great mooueable circles, passing through the Poles of the world, crossing one another in the saide Poles with right Sphearicall angles, by meanes whereof they diuide the whole Spheare into foure equall parts, of which two Colures the one is called the Colure of the Equinoxes, and the other the Colure of Solstices.

Describe these two Circles, & shew why they are so named?

The Colure of the Equinoxes is so called because it cutteth the Zodiaque in ỹ beginning of Aries, which is called the vernal Equinoxe: and also in the beginning of Libra, which is called the Autumnall Equinoxe, at which two times the daies and nightes be equall, as hath beene saide before when we did speake of the Equinoctiall circle, and this circle deuideth the Ecliptique into two halfes, the one Septentrionall, and the other Meridionall, and thereby sheweth the signes wherein the Sunne maketh the dayes longer and shorter than the nights, for whilest he is in the 6. Northern signes, he maketh the dayes with vs longer then the nightes: and when he is in the 6. Southerne signes he maketh the nightes longer then the daies: now you haue to vnderstand that the Colure of the Solstice, is so called, because it cutteth the Zodiaque in the two Solstitiall pointes, that is to say, in the beginning of Cancer, and the beginning of Capricorne, as you may see in beholding & turning the Spheare about with your hand.

Why are these two points called Solstitiall?

They take their name of these two Latine words Sol and statio, that is to say, the Sun and standing, for when the Sunne is in any of the two points, hee seemeth to stand still, or at the least moo-

mooueth so little, as his proper mooving from West to East cannot be easily perceiued, during the space of twelue dayes. And you haue to note, that when the Sunne entereth into the first degree of Cancer, which is about the 12. of June, then hee is at the highest, and the dayes be at the longest, and therefore, it is called the Summer Solstice. Againe, when hee entreth into the first degree of Capricorne, which is about the 12. of December, then the Sunne is at the lowest, and the nights are at the longest, & therefore it is called the Winter Solstice. And in this Colure there are set downe the two Poles of the Ecliptique line being distant from the Poles of the world 23. degrees and 28. Moreouer on this Colure is measured the greatest declination of ꝑ Sun, which is alwaies equall to the distance of the Pole of the Ecliptique, from the Pole of the world, as hath beene said before. And you haue to note that the 4. former points, that is to say, the 2. Equinoxes, and the 2. Solstices, are commonly called the foure cardinall or principall points, and of some they are called the foure pointes of Change, signifying the 4. beginnings of the foure diuers seasons of the yeare, for betwixt the beginning of Aries and beginning of Cancer, is contained the Spring time, and betwixt the beginning of Cancer and the beginning of Libra is the Summer time: and from the beginning of Libra to the beginning of Capricorne is the time called Autumne, or fall of the leafe: and from the beginning of Capricorne to the beginning of Aries is contayned the winter season, albeit the Sunne entreth not into any of these signes alwayes at one selfe day or time of the yeare, for at Christ his incarnation, the Sunne entred into Aries the 25. of March, and into Cancer the 24. of June, and into Libra the 27. of September, and into Capricorne the 25. of December, which was then the shortest day in the yeare, and the beginning of Winter, and therefore is called of the Latines, dies brumalis, on which day Christ our Sauiour was borne, so as from the time of his birth vnto this present yeare, there are runne almost 13. dayes, wherefore, vnlesse the Kalenders bee reformed as well here in England as elsewhere (for the Romane reformation is not so exactly true as it might bee) wee shall haue in processe of time, the Spring in Winter, and the Winter in Autumne.

How

How shall I know this present yeare, or any yeare to come hereafter, at what day and houre the Sunne entreth into any of the 12. Signes?

First you must learne by some good Ephemerides, or other Table, the true entrance of the Sun into euery signe in any yeare passed before, then from the time of the entrance of the Sunne into the signe which you desire to know, consider how many yeares are betwixt, and how many leape yeares are in the same contained, and subtract for so many times as there be leape yeares, 4'4. of an houre, and adde to the houres remaining, so many times fiue houres, and 4'9. as there be yeares remaining ouer and besides the leape yeare, and that summe shall shew you the day, houre and minutes of the true entrance of the Sunne into that signe in the same yeare that you desire to know.

Of the Horizon both right and oblique, making thereby three kinds of Spheares, that is, the right, the Paralell, and the oblique Spheare.

Cap. 17.

WHat is the Horizon?

It is a great immoueable circle which deuideth the vpper Hemisphere, which is as much to say, as the vpper halfe of the world which we see, from the nether Hemisphere which we see not, for standing in a plaine field, or rather vpon some high mountaine void of bushes & trees, and looking round about, you shall see your selfe inuironed as it were with a circle, and to be in the very midst or center thereof, beneath or beyond which circle, your sight cannot passe, and therefore this circle in Greeke is called Horizon, and in Latine Finitor, that is to say, that which determineth, limiteth or boundeth the sight, the Poles of which circle are imagined to be two points in the firmament, whereof the one standeth right ouer your head, called in Arabick Zenith: and the other directly vnder your feete, called in the same tongue Nadir, that is to say, the pointe opposite, and from point to point you must imagine that there goeth a right line passing through the center of the world, and also through

through your body both head and feet, which is called the Axletree of the Horizon, and you haue to vnderstand that of Horizons there be 2. kinds, that is, right & oblique, making 3. kinds of Spheares, that is to say, the right Spheare, the paralel Spheare, and the oblique Spheare.

VVhen is the Horizon said to be right, and thereby to make a right Spheare?

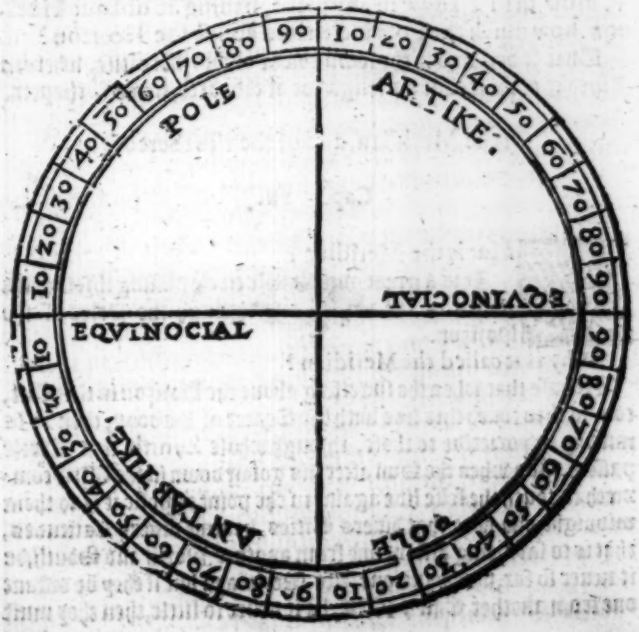
It may be said to be right two manner of waies, first, when the Horizon passeth through both the Poles of the world, cutting the Equinoctiall with right angles, in which Spheare they that dwell haue their Zenith in the Equinoctiall, which passeth right ouer their heads, to whom the daies and nights are alwaies equal. Secondly, they are said to haue a right Horizon, & to dwell in a right Spheare, to whom one of the Poles of the world is their Zenith, and their Horizon is all one with the Equinoctial, cutting the Axletree of the world in the very midst with right angles, and because the Horizon & the Equinoctial are Paralels, this kind of Spheare is called a paralel Spheare, in which Spheare they that dwel haue 6. moneths day, & 6. moneths nights, as you may easily perceiue by placing the Spheare, so as one of the Poles may stand right vp in the midst of the Horizon, by means whereof you shal see 6. signes of the Zodiaque to be alwaies aboue the Horizon, and 6. signes to be alwaies vnder the Horizon: Againe by placing the Spheare so as both the Poles may lye vpon the Horizon, you shall see the shape of the first right Spheare, wherein the Horizon passeth through both the Poles of the world, and the Equinoctiall passeth through the Poles of the Horizon, which are the two points called before the Zenith and Nadir.

When is it said to be an oblique Horizon, and thereby to make an oblique Spheare?

When the Pole of the world is eleuated aboue the Horizon, be it neuer so little, so as the Horizon doe cut the Equinoctiall with oblique Angles, and looke how much the Pole of the world is eleuated aboue your Horizon, so much is your Zenith distant from the Equinoctiall, and the nigher that your Horizon approcheth to the Pole, the nigher your Zenith approcheth to the Equinoctiall. Againe, looke how much the Equinoctiall is eleuated aboue your Horizon, so much is your Zenith distant from the Pole, all which

things this figure here following doth plainly shew, whereby you may easily perceiue that the latitude, which is the distance of your Zenith from the Equinoctiall, is alwaies equall to the altitude of the Pole, which is the distance betwixt your Horizon and the Pole, as for example, knowing ỳ latitude of Norwich to be 52. degrées, lay the Zenith of this figure vpon the 52. degrées, reckoning from the Equinoctiall towards the Pole Arctique on your left hand, and loke what distance is betwixt the said Zenith and the Equinoctiall, the selfe same distance you shall find to be betwixt the Horizon and the foresaid Pole on your right hand, and you may doe the like vpon the Spheare it selfe by raising the mouable Meridian aboue the Horizon at that altitude, so as the 52. degr. may be euen with the Horizon.

A figure shewing the Latitude of any place to be equall to the eleuation of the Pole.



What other vses hath this Circle?

In this circle are set downe the foure quarters of the world, as East, West, North, and South, and the rest of the winds: Againe, this circle deuideth the artificiall day from the artificiall night, for all the while that the Sun is aboue the Horizon it is day, & whilest it is vnder the same it is night. And by this Circle we know what starres do continually appeare, and which are continually hidden, also what starres doe rise and goe downe. Againe, in taking the eleuation of the Pole, this Circle is chiefly to be considered, for when we know how many degrees the Pole is raised aboue the Horizon, then we haue the eleuation thereof for that place. For to euery seuerall place, yea to euery little moment of the earth in an oblique Spheare, belongeth his proper Horizon and seuerall Altitude of the Pole, whereby it appeareth that the Horizons are infinite and without number.

How shall I know in any place, hauing an oblique Horizon, how much the Pole is eleuated aboue the Horizon?

That is declared in the second booke of this Treatise, whereas I speake of the latitude & longitude of the earth, in the 8. chapter.

Of the Meridian, and of the vses thereof.

Cap. 18.

WHat is the Meridian?

It is a great immouable circle passing through the Poles of the world, and through the Poles of the Horizon.

Why is it called the Meridian?

Because that when the sun rising aboue the Horizon in the East, commeth to touch this line with the Center of his body, then it is midday or noone tide to those, through whose Zenith that Circle passeth. And when the Sun after his going downe in the West commeth to touch the selfe line againe in the point opposite, it is to them midnight. Also note that diuers Cities, hauing diuers Latitudes, that is to say, being distant one from another North and South, be it neuer so far, may haue one selfe Meridian: but if they be distant one from another East & West, be it neuer so little, then they must needes

needes haue diuers Meridians, and such distance betwixt the two seuerall Meridians, is called the difference of Longitude, whereof we shal speake hereafter more at large when we come to treate of the Longitude and Latitude of the earth, which something differeth from the Longitude and Latitude of the starres or Planets, whereof we haue already spoken in the 11. Chapter.

How many *Meridians* be there?

The Astronomers doe appoint for euery two degrees of the Equinoctiall a Meridian, so as they make in all 180. Albeit most commonly in the Spheare they set downe but one, which serueth for all by turning ꝑ body of the Spheare to it, which for that cause is called the moueable Meridian. And in such Spheares as haue not a foote and a standing Horizon, there is no Meridian at al, but the two Colures are faine to supply their want, but al terrestriall Globes are commonly described with twelue Meridians, cutting the Equinoctiall in 24. points, and deuiding the same into 24. spaces, euery space containing 15. degrees, which is an houre, by meanes whereof we know how much sooner or latter it is noontide in any place, for it is noonetide sooner to those whose Meridian is more Eastward then to them whose Meridian is more Westward. And contrariwise the Eclipse of the Sun or Moone appeareth sooner to those whose Meridian is more Westward.

What other vses hath this circle?

This circle deuideth the East part of the world from the West, and also it sheweth both the North and South, for by turning your face towardes the East, you shall finde the Sunne being in that line at noontide to bee on your right hand right South, the opposite part of which circle sheweth on your left hand the North. Also this Circle by reason that it passeth through both the Poles of the world, deuideth both the Equinoctiall and all his Paralels into two equall parts aswell aboue the Horizon, as vnder the Horizon, and by that meanes it deuideth the artificial day and artificiall night each of them into two parts, that is to say, into two semidiurnall and into two seminocturnall parts. For betwixt that part of the Horizon where the Sun riseth, mounting still vntill he come to this Circle, which is at noontide, is contained the first halfe of the day, & the other halfe is from the same circle to the going down of the Sunne vnder the Horizon. And the first parte of the night is

the space betwixt the Suns going downe & his comming againe to the Meridian, which is at midnight, and from thence to the time of his rising is the other halfe of the night, and also the Astronomers take the beginning of their naturall day from this circle, counting either from noontide to noontide, or else from midnight to midnight. Againe, this circle sheweth the right ascentions and declinations of the starres, and the highest altitude, otherwise called the Meridian altitude of the Sun or of any star, or degree of the Ecliptique, or of any other point in the firmament, all which vses and many others more you shall better vnderstand hereafter, when we come to shew the vses of the globe as well terrestriall as celestiall.

Of the verticall circles, and vses thereof.

Cap. 13.

BVt here you haue to note, that though the most part of Geographers doe set downe in their Spheres but 6. great circles, yet there is another great circle called ỹ circle Verticall, which passeth right ouer our heades through our zenith, whersoeuer we be vpon the land or sea crossing our Horizon in 2. points opposite, and deuiding the same into two equall parts, and such kind of circles are called in Arabick Azimuthes, whereof you may imagine that there be so many as there be rombes or winds in the Marriners compasse, which are in number 32. yea and if you will, you may make halfe so many as there be degrées in the Horizon, which are in nũber 360. the halfe whereof is 180. If you be right vnder the Equinoctiall, and doe goe or saile right East or West, then the Equinoctiall is your Verticall circle, and if you goe or saile right North or South, then the Meridian is your verticall circle, which two circles notwithstanding do alwaies keepe their names. But in sailing by any other rombe, that circle which is imagined to passe from the true East pointe right ouer your head vnto the true West point, or which crosseth your Meridian in the Zenith point with right Sphericall angles, is most properly called the verticall circle, and the learned seamen haue great respect to two speciall kinds of Verticall circles, that is, the Magnetical Meridian, and the Azimuth of the Sunne.

What

What manner of verticall Circles be those, and whereto serue they?

M. Borrough in his discourse of the variation of the Compasse, defineth the Magneticall Meridian to be a great Circle, which passeth through the Zenith and the Pole of the load stone called in Latine Magnes, and deuideth the Horizon into two equall parts, by crossing the same into two points opposite. Againe the Azimuth of the Sunne is a great Circle, passing through the Zenith, and the Center of the Sunne in what part of the heauen so euer he be, so as he be aboue the Horizon, which Circle deuideth the Horizon into two equall parts, by crossing ẏ same into two points opposite. And by helpe of these two Circles and a certaine instrument made of purpose to giue a true shadow, he teacheth to finde out the true Meridian of any place: And also to know how much any Mariners Compasse doth varie from the true North and South, in North-easting or North-westing, whereof I shall speake more at large hereafter in my treatise of Nauigation.

What vse is there of the verticall Circles, or Azimuthes?

The verticall Circle sheweth what time the Sunne or any other starre rising beyond the true East pointe, is passed that Sunne or said Starre, commeth to the true East or any other rombe. Also in what Coast or part of heauen the Sunne, Moone, or any other starre is at any time being mounted aboue the Horizon, as whether it be Southeast or Northeast, or in any other rombe: Also by helpe of the verticall Circle most properly so called, are the twelue houses of heauen set, according to Campanus and Gazula. And by helpe of these Circles you may also know how any place vpon the earth beareth one from another either Eastward or Westward, and so forth, for euery place hath his seuerall Azimuth answerable to the Horizon and Zenith of the said place.

Of certaine Circles called Almicanterathes?

Since I haue spoken here somewhat of the verticall Circles called Azimuthes, it shall not be amisse to shew you also that there be other Circles to be considered of in the Spheare as well as in the Astrolabe called Almicanterathes, that is to say, Circles of Altitude, which though they be not all great Circles, for euery one

is lesser then other proceeding frō the oblique Horizon of any place to the Zenith of the said place, yet the first Almicanterath which is the very oblique Horizon it selfe, is a great Circle deuiding the Spheare into two equall parts, and all the rest are lesser & lesser, vntill you come to the very Zenith, and are paralels to the Horizon, euen as the Tropiques and the other lesser Circles are paralels vnto the Equinoctiall. And the Zenith, in Spherical bodies is the Center of them all, though it be not so in Astrolabes, for there euery Almicanterath is faine to haue his seuerall Center, of which Circles there be in all 90. according to the number of 90. degrees contained betwixt the oblique Horizon and the Zenith, and these Circles doe serue to shew the Altitude of the Sunne or Moone, or of any other starre fixed or wandring, being mounted at any time aboue the oblique Horizon, which is easie to be found by any Quadrant, Crosse-staffe, or Astrolabe: but leauing to speake any further of these Circles, because they are not vsed to be described in Spheares but onely in Astrolabes, I will now treate of the foure lesser Circles before mentioned, which are commonly set downe in euery Spheare or Globe.

Of the foure lesser circles, that is to say, the circle Arctique, the circle Antarctique, the Tropique of Cancer, and the Tropique of Capricorne, and also of the fiue Zones, that is to say, two cold, two temperate, and one extreamely hoat.

Cap. 10.

WHich call you the lesser Circles?

They are those that doe not deuide the Spheare into two equall parts, as the great Circles doe, and of such there be foure, that is the two Polar circles, and the two Tropiques, that is to say, the Tropique of Cancer, and the Tropique of Capricorne, of which Polar circles the one is called Artique, and the other Antarctique, and are made by the turning about of the two Poles of the Zodiaque, which Poles being situated in the Colure of the Solsti-

Solstices are so farre distant from the Poles of the world, as is the greatest declination of the Sunne from the Equinoctiall, which is 23. degrees, 28. as hath beene said before.

VVhich is the Arctique Circle, and why is it so called?

The Arctique Circle is that which is next to the North Pole, and hath his name of this word Arctos, which is the great Beare or Charles wayne, which are seuen stars placed next to this Circle on the out side thereof, and it is otherwise called the Septentrionall Circle of this word Septentrio, which is as much to say, as seuen Oxen, signified by the seuen stars of the little Beare, which doe moue slowly like Oxen, and are placed all within the same Circle, and the bright starre that is in the eye of the staple of the said litle Beare, is called of the Mariners the loade starre or North starre, wherby they saple on the Sea, and the Centre of this Circle is the North Pole of the world which is not to be seene with mans eye.

What is the Antractique Circle?

It is that which is next vnto the South Pole, and is so called, because it is opposite or contrarie to the Circle Arctique.

Now describe the two Tropiques.

The Tropique of Cancer is a Circle imagined to be betwixt the Equinoctiall and the Circles Artique, which Circles the Sun maketh when he entreth into the first degree of Cancer, which is about the twelue or thirteenth day of June being then in his greatest declination from the Equinoctiall Northward, and nighest to our Zenith, being ascended to the highest point that he can goe, at which time the daies with vs be at the longest, and the nightes at the shortest. And so from thence he declineth to the other Tropique called the Tropique of Capricorne, which is a Circle imagined to be betwixt the Equinoctiall and the Circle Antartique, which the Sun maketh when he entreth into the first degree of Capricorne, which is about the twelfth or thirteenth day of December, at which time hee is againe in his greatest declination from the Equinoctiall Southward, and furthest from our Zenith: wherby the dayes with vs be then at the shortest, and the nights

at the longest: And note that these two Circles are called Tropiques, of this Greeke word Tropos, which is as much to say as a conuersion or turning, for when the Sunne arriueth at any of these two Circles, he turneth backe againe either ascending or descending, by reason of which foure Circles as well the firmament as the earth is deuided into fiue Zones, that is to say, two colde two temperate, & one extreamely hoat otherwise called ỹ burnt Zone, of which fiue Zones, the foresaid foure circles are the true bounds For of the two cold Zones, the one lyeth betwixt the North pole and the Circle Arctique, and the other lyeth betwixt the South Pole and the Circle Antarctique, and of the two temperate Zones, the one lyeth betwixt the Circle Arctique, & the Tropique of Cancer, and the other lyeth betwixt the Circle Antarctique, and the Tropique of Capricorne, & the extreame hoat Zone lyeth betwixt the two Tropiques, in the middest of which two Tropiques, is the Equinoctiall line, as you may see in this figure and also in the Spheare or Globe it selfe.

A figure shewing the fiue foresaid Zones.



Of which Zones the auncient men were wont to say, that three were vnhabitable, that is, the two colde and the extreame hoate, which experience sheweth in these latter dayes, to be vntrue, as wee shall declare more at large when wee come to treate of the diuision of the earth: Againe you haue to vnderstand that euery one of these lesser Circles doth containe in length, 360. degrees as wel as euery one of the greater Circles, but the degrées are not of like bignesse, no more then the Circles themselues are like in compasse or circuit, for the lesser the Circles are in Circuit, the lesser their degrees must needs be.

Sith euery of the lesser Circles differ one from another in circuit, and thereby the degrees of euery circle bee lesse then other, how shall I know the true quantity of euery degree in ech circle, and how many minutes are required in euery lesser degree porportionally to answere one degree of the Equinoctiall.

For the better knowledge hereof, you must first imagine that there may be as many Circles made from the Equinoctiall towards any of the Poles, as there be degrees of Latitude which are in number 90. as hath been said before: And the the nigher that any circle is to the Equinoctiall, the greater it is in circuit, and the further from the Equinoctiall towards any of the Poles, the lesser in circuit, & therefore more or lesse minutes are requisite to answere to one degree of the Equinoctiall, as you may easily perceiue by this Table following, consisting of 6. collums euery front or head whereof is noted with three great letters, D.M.S. signifying degrees, minutes and seconds, fiue times repeated, and in the beginning of the first collum on the left hand is set downe one degree, which is the first degrée of 90. and nighest vnto the Equinoctiall right against which one degree is placed towards the right hand, 59. minutes, and 59. seconds: and so proceeding from degrée to degree successiuely, vntill you come to 90. you shall finde how many minutes and seconds doe answere to one degree of the Equinoctiall, and this Table wil also serue to shew the difference of miles in euery sundry clyme or paralell, whereof we shall speake hereafter when we come to treat of the earth.

A Table shewing how many minutes are requisite to make tone degree, in euery lesser Circle answerable to one degree of the Equinoctiall.

D	M	S	D	M	S	D	M	S	D	M	S	D	M	S	D	M	S
1	59	59	16	57	41	31	51	26	46	41	41	61	29	5	76	14	31
2	59	58	17	57	23	32	50	53	47	40	55	62	28	10	77	13	30
3	59	53	18	57	4	33	50	29	48	40	9	63	27	14	78	12	28
4	59	51	19	56	44	34	49	45	49	39	22	64	26	18	79	11	27
5	59	46	20	56	23	35	49	9	50	38	34	65	25	21	80	10	25
6	59	40	21	56	1	36	48	32	51	37	46	66	24	24	81	9	23
7	59	33	22	55	38	37	47	55	52	36	56	67	23	27	82	8	21
8	59	25	23	55	14	38	47	17	53	36	7	68	22	29	83	7	19
9	59	16	24	54	49	39	46	38	54	35	16	69	21	30	84	6	16
10	59	5	25	54	23	40	45	58	55	34	25	70	20	31	85	5	14
11	58	54	26	53	56	41	45	17	56	33	33	71	19	32	86	4	11
12	58	41	27	53	28	42	44	35	57	32	41	72	18	32	87	3	8
13	58	28	28	52	59	43	43	53	58	31	48	73	17	33	88	2	5
14	58	13	29	52	29	44	43	10	59	30	54	74	16	32	89	1	3
15	57	57	30	51	58	45	42	26	60	30	0	75	15	32	90	0	0

Of the starres and celestiall bodies contained in the firmament, and first of their substance.

Cap. 21.

HAuing briefly described all the Circles as well greater as lesser that are imagined to be in the 8. heauen, I thinke it good now to speake somewhat of the starres and celestiall bodies, placed in the saide heauen. And first of their substance, & then of their mouing, figure, shape, number, magnitude or greatnes, also of their Longitude, Latitude

Latitude, declination, ascention, descention both right and oblique, and of the ascentionall difference, and finally of the threefold Poeticall rising and going downe of the Starres, but first of their substance.

Of what substance are the Starres?

The Starres be of the same substance that the heauens are wherein they are placed, differing onely from the same in thicknes, and therefore some defining a Starre doe say, that it is a bright and shining body, and the thickest part of his heauen, apt both to receiue and to reteine the light of the Sunne, and thereby is visible and obiect to the sight: for the heauen it selfe being most pure, thinne, transparent, and without colour is not visible, and for this cause the milke-white impression in heauen like vnto a white way called of the Astronomers Galaxia, and of the common people our Ladies way, is visible to the eye, by reason that it is thicker then any other part of the heauen.

Why are not the Starres seene as well in the day, as in the night.

Because they are darkened by the excellent brightnesse of the Sunne from whom they borrow their chiefest light.

Of the mooning and shape of the Starres.

Cap. 22.

WHat mooning haue the Starres?

The selfe same mouing that the heauen hath wherein they are placed.

Whereby are the heauens mooued?

Some say, that the first moueable is turned by God himselfe, and all the rest of the heauens euery one by his proper intelligence, which though it turneth his heauen about, yet it giueth neither life, sense, nor vnderstanding thereunto, as some haue vntruely holden, affirming the heauens to be liuing and intelligible bodies.

If

If the Starres haue no mooving of themselues, whereof commeth it then, that some seeme to our sight sometime nigher and sometime further off.

All the fired Starres of the firmament are alwaies of like distance, notwithstanding by reason of the manifold mœuing of the firmament, wherein they are placed, they seeme to change their places, and sometimes to be more towardes the East or West, North or South. And whereas the vii. Planets called the wandring Starres, doe change their places now here now there, that chanceth not by their own mœuing, but by the mooving of the heauens wherein they are placed: for a Starre being round of shape hath no members meete to walke from one place to another, but onely changeth his place through the motion of his Spheare or heauen wherein such Planet is fired.

Of the number of the Starres, and of their magnitude or greatnes, and into how many Images they are deuided, and how many Starres euery Image containeth.

Cap. 23.

MAy the Starres be numbred by man? No, for as Dauid saith, that belongeth onely to God, who as he created them, so he can number them and call them all by their names, notwithstanding the Astronomers by their industrie and diligent obseruation, haue attained to the knowledge of many: as first they know the seuen Planets, otherwise called the wandring starres, and haue made manifest demonstrations of their motions, and by continuall obseruation haue found out the manifold vertues, powers and influences of the same, but of the fired Starres they could neuer finde more then 1022. and because the starres are not equall in greatnes or bignesse, they make fiue differences of greatnesse, appointing to the first difference 15. starres, which are bigger then all the rest, whereof euery one containeth the earth 207. times, to the second difference 45. starres, whereof

euery

euery one containeth the earth 90. times. To ỳ third they appoint 208. starres, whereof euery one containeth the earth 72. times. To the fourth difference they appoint 474. starres, whereof euery one containeth the earth 54. times, to the fift they assigne 217. starres, whereof euery one containeth the earth 57. times. To the sixt or last greatnesse they appoint 49. small starres, whereof euery one containeth the earth 18. times, and some say 20. times. Besides these there be 14. others, whereof 5. be called clowdy and the other darke, because they are not to be seene but of a very quicke and sharpe sight. And you haue to note that the auncient Astronomers do deuide all the fixed stars to them known into 48. images, wherof they liken some to liuing things as to men, women, beasts, monsters, foules, fishes, and creeping wormes, and some to things without life, hauing some artificiall shape, of which 48. images, they appoint 12. to the Zodiaque, commonly called the 12. signes, as Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius and Pisces. Againe they place in the North part of the firmament 21. images, and in the South part thereof 15. images, which make in all 48. The description of all which images, together with their names hereafter followeth: and first I will describe vnto you the twelue Images contained in the Zodiaque.

Of the xii. Images or signes of the Zodiaque.

Cap. 24.

THe twelue signes (as some affirme) doe containe of the foresaide number of fixed starres 273. for the first signe called Aries, that is to say, the Ramme, containeth 13. starres, which Image or signe being placed in the coniunction of the Zodiaque with the Equinoctiall, hath his backe turned towardes the North, and his head towardes the East, and riseth with his head, and goeth downe with his feete. The second signe called Taurus, that is to say, the Bul, containeth 35. starres, whereof there is one bright starre of the

first

first bigneſſe called Oculus Tauri, that is to ſay, the Bulles eye, who hath his head enclined towards ỹ Weſt as though he loked towards the earth, and riſeth and goeth downe with his heeles vpwarde. The thirde Signe called Gemini, that is to ſay, the twinnes, doe containe 18. ſtarres, their heads looking towards the Noꝛth, and their backes being ioyned together doe embꝛace one another, doe riſe lying, and doe goe downe with their feete. The fourth Signe called Cancer, that is to ſay, the Crabbe containeth nine ſtarres, extending his feete towards both the Poles, and looking towards Leo, hath his bellie turned towards the earth, and hee riſeth and falleth with his hinder part oꝛ backe part of his body. The fift Signe called Leo, that is to ſay, the Lyon containeth ten ſtarres, whereof there be two bꝛight ſtarres of the firſt bigneſſe, the one in his bꝛeaſt called Cor Leonis, and Regulus, that is to ſay the Lyons heart, and the other in his taile called Cauda Leonis, that is to ſay, the Lyons tayle, who looketh towardes Cancer, and hauing his backe turned towardes the Noꝛth, he riſeth and goeth downe with his head. The ſixt Signe called Virgo, that is to ſaye, the Virgine, whoſe head is behinde the Lyon and toucheth the Equinoctiall line with her left hande, holding in the ſame hand an eare of Coꝛne, ſhe both riſeth and goeth downe with her head: this Image containeth ſixe and twentie ſtarres, whereof there is one bꝛight ſtarre of the firſt bigneſſe, called Spica Virginis, that is to ſaye, an eare of Coꝛne. The ſeuenth Signe called Libra, that is to ſaye, the Ballance, containing eight ſtarres hath two ſkales, whereof the one hangeth towardes the Noꝛth, and the other towardes the South. The eight Signe called Scorpios, that is to ſaye the Scoꝛpion, contameth one and twentie ſtarres, who looketh towardes Virgo, and exteadeth his feete towards both the Poles, hee boweth his tayle towards the Noꝛth, hauing his bellie turned towardes the earth, and he riſeth and goeth downe bowing: The ninth Signe called Sagittarius, that is to ſaye the Archer, containing one and thirtie ſtarres, hath his heade towardes the Noꝛth, and looketh towardes the Scoꝛpion, hauing a bowe and a ſhaft, whereof the bowe toucheth his left hande and left foote, hee riſeth right vppe and goeth downe headlong. The tenth ſigne called Capricornus that is to ſaye, the Goate containing eight and twentie ſtarres,

hath

hath his backe turned towards the North, and his head towards the Archer, and turning himselfe towardes Aquarius, he riseth right vp, and goeth downe headlong. The eleuenth Signe called Aquarius, that is to say, the water bearer containing two and fortie starres, hath his head towards the North, extending his left hand vpon the backe of Capricorne, and with his right hand powreth out water out of his potte, which bendeth towards the East, runneth euen to Pisces, he riseth and goeth downe with his head before any other of his members. The twelfth Signe called Pisces, that is to say, two Fishes, doe containe foure and thirtie stars, whereof the backe of the first is towards the North, and the backe of the second towardes the West arme of Andromeda, and one of the Fishes loketh towards Aquarius, and the other towardes the North, and betwixt these two Fishes is a certaine little line wherewith their tayles are bound together as it were with a bond, the lower part of which Fishes, both alwaies both rise and goe downe, and not the vpper part: And though the 12. Signes of the Zodiaque are said to be equall both in length and breadth, that is to say, hauing thirtie degrées in length, and twelue degrées in breadth, as hath beene said before, yet these Images are not equall, for some doe extend further then the Zodiaque in breadth, and some are more then 30. degrées in length. As the Tables of Alphonsus doe manifestly shew, who sayeth there that the twelue Signes doe containe three hundred and fiftie starres, for he appointeth to Aries eighténe, to Taurus fortie foure, to Gemini twentie fiue, to Cancer thirténe, to Leo thirtie fiue, to Virgo thirtie two, to Libra seuenténe, to Scorpio twentie foure, to Sagittarius thirtie and one, to Capricornus twentie eight, to Aquarius fortie fiue, to Pisces thirtie eight, which make in all three hundred and fiftie, in which Tables are also set downe the Longitude, Latitude, and Magnitude of the said Starres, but the Longitude of the said Stars, is farre altered from that Longitude which they had in his time, whereof we shall speake hereafter more at large.

Of

Of the xxi. Northerne Images.

Cap. 25.

WHich be they?

These here following, first Vrsa minor, that is to say, the lesser Beare containing 7. starres, the taile starre whereof being a bright starre of the third bignesse is called the loadstarre: The second is called Vrsa maior, that is to say, the great Beare containing 27. starres, whereof there be 7. principall, making a shape like vnto a Cart with foure wheeles, and therefore it is commonly called Charles waine. The third is called Draco, that is to say, the Dragon that kept Iunos Orchard from robbing, containing 31. stars. The fourth is called Cepheus, the proper name of a King of Ethiope, containing 11. stars. The fift is called Bootes, that is to say, the roaring keper of the Beare, containing 22. starres, whereof there is one bright star betwixt his legges, of the first bignesse called Arcturus. The sixth is called Corona Ariadnæ, that is to say, the Crowne of Ariadna the daughter of king Minos, containing 8. starres. The seuenth is Hercules, who lieth groueling with his heeles towards the North Pole, holding a clubbe in his right hand, and a Lyons skin hanging on his left arme containing 28. stars. The eight is called Lyra, that is to say, an instrument of musicke like a harpe placed in heauen in the memorie of Orpheus, cõtaining 10. stars. The ninth is called Cignus, that is to say, the Swanne, into which Iupiter transformed himselfe to deceaue the Nymph Læda, containing 17. starres. The tenth is called Calsiopeia sitting in her chaire, wife to Cepheus, & mother to Andromeda, containing 13. stars. The eleuenth is called Perseus, holding his sword in the one hand, & the head of Gorgon or Medusa in the other hand, whose haires were all Serpents, containing 26. starres. The twelfth is Auriga and Erichonius, who was the inuentor of the first Chariot that euer was made, containing 13. starres. The 13. is called Serpentarius and Anguitenens, that is to say, he that holdeth the Serpent, who (as some thinke) was AEsculapius the famous Phisitian,

Phisitian, containing 24. starres. The 14. is called Serpens, or Anguis, that is to say, the Serpent of Esculapius containing 18. starres. The 15. is called Sagitta or Telum, that is to say, ỳ shaft or dart wherewith Hercules slew the Eagle tormenting Prometheus in the mount Caucasus, containing 5. stars. The 16. is called Aquila, that is to say, the Eagle which caried Ganimedes into heauen containing 9. starres. The 17. is called Delphinus, that is to say, the Dolphyn, which saued Arion that excellent Musitian, being cast by Pyrats into the sea containing 10. stars. The 18. is called minor Equus, that is to say, the lesser Horse, containing only 4. little darke stars in his head. The 19. is the great Horse called Pægasus, that is to say, the winged Horse, wherewith Bellerophon conquered the monstrous beast called Chimera, which was halfe a Lyon and halfe a Dragon, and is adorned with 20. starres. The 20. is called Andromeda the daughter of Cepheus by Cassiopeia, and wife to Perseus, who for her constant loue towards her husband, was placed in heauen nigh vnto him, and was adorned with 23. Starres. The 21. is called Triangulum, that is to say, a Triangle or three cornerd figure, which being like in shape to the Ile Cicilia the Goddesse Ceres obtained to be placed in heauen, & was adorned with 4. starres, that is to say, euery corner one, & the fourth in the midst of the shortest side: To these (in mine opinion) ought to be added Bernices haire called crinis Bernices, which in all celestiall globes is placed not farre from the right hinder foote of the great Beare, and this Image containeth 4. little starres.

Of the 15. Southerne Images.

Cap. 26.

WHich be they?

These hereafter following, whereof the first is called Cætus, that is to say, the Whale, that monstrous fish which by the appointmẽt of Neptune, would haue destroyed Andromeda, whom Perseus deliuered by killing the Fish, and afterwardes tooke Andromeda to wife, which Fish Neptune placed in heauen, adorning the same with two and twentie Starres.

The second is called Orion with his sword by his side, who afterward was slaine by Diana by mis-hap against her will, for the which she placed him in heauen, adorning him with 38. Starres, whereof there be two bright starres of the first bignesse, the one in his right shoulder called Bed Alguze, and the other in his left foote called Rigell Alguze. The third is the flood called Eridanus, into the which Phaeton the sonne of Apollo was stroken with a thunderbolt by Iupiter, for burning the earth by rashly driuing his fathers Chariot, which he was not able to guide, in memorie whereof the flood was placed in heauen, and adorned with 34. Starres, whereof one is a bright starre of the first bignesse called Acarnar. The fourth is called Lepus, that is to say, ꝑ Hare, placed nigh vnto Orion, because he was a hunter, adorned with 12. starres. The fift is called Canis maior, that is to say, the great Dogge, passing all others in swiftnesse, which was giuen by Aurora to Cepheus the sonne of Eolus, and is placed next to the Hare, being adorned with 18. starres, whereof there is in his mouth a very faire starre of the first bignesse called Syrius. The sixth is called Canis minor, that is to say, the lesser Dogge, without the which Orion his master would not be placed in heauen, which hath but two Starres, whereof the one is in his flanke, and is a bright star of the first bignesse called Canicula and Procion. The seuenth is the ship called Argos, in the which Iason & his companions sayled to Colcos to winne the Golden Fleese, which is adorned with 45. stars, whereof there is one bright star of the first bignesse in the left oare called Canopus. The eight is called Hydra, that is to say, ꝑ Water-serpent which Hercules slewe, or as some say, which kept the waterbowle, and would not suffer the thirstie Crowe to drinke, which Crowe Apollo sent for water to do sacrifice, and is adorned with 25 starres. The ninth is called Crater, that is to say, the Cup or Bowle which the Crowe brought too late vnto Apollo, and therefore his feathers were made all blacke whereas before they were white, containing 7. starres. The tenth is called Coruus that is to say, the Crowe before mentioned, adorned with 7. starres. The 11. is called Chiron siue Centaurus, the Son of Saturne passing all others in iustice and religion, and therefore is figured in heauen as though he were offring sacrifice vpon an altar adorned with 37. stars whereof there is one bright starre of the first bignesse in

his

his right foote called Chiron and Centaurus. The twelfth is called Lupus, that is to say the Wolfe, into which Licaon the cruell Tirant was turned by Iupiter, or as some say that Wolfe which Centaurus killed to do sacrifice vpon ỹ altar containing 19. starrs. The thirteenth is called Ara, that is to say, the Altar made by the Smithes of Vulcane, whereupon all the Goddes sware to reuenge the insolencie and pride of the Giants, which altar is placed next to Centaurus being adorned with 7. starres. The fourteenth is called Corona Astralis that is to say, the Southerne Crowne which Bacchus did weare when he fetched his mother Semele frō hel, which is placed in heauen, & is adorned with thirteene starres. The fifteenth and last of the Southerne signes is called Pises Australis, that is to say, the Southerne Fish which was placed in heauen in memorial of the fishes which the people of Syria did worship as their Goddes, and is adorned with 12. starrs, whereof there is one bright starre of the first bignesse in his mouth called Fomahant: All which Images and Signes before mentioned, as well Northerne as Southerne, you may see plainely described in euery celestiall Globe, and also set forth in Plano in the neither ende of Vopellius his vniuersal Map, that is to say, the Northerne signes on the left side, and the Southerne signes on the right side of the Map: Or in the front of Plancius his great vniuersall Map, who in the rondle representing the Southerne halfe of the celestiall Globe, setteth downe also certaine Southerne starres lately found out by the trauellers into the Indies, as the Crosse, the Southerne Triangle, Noe his Doue or Pigion, & another in shape of a man called Polophilax, so as there be now in al 19. southerne Images.

Of the longitude of the fixed starres, and of the præcession of the vernall Equinoctiall point, and what it is.

Cap. 27.

WHat is the Longitude of a starre?

The Longitude of any Starre, is that Arke or portion of the Ecliptique line which is contained betwixt the first point of Aries, and that Circle which passeth through the Poles of the Zodiaque,

and also through the bodie of the starre, as for example the star called Cor Leonis is distant in these dayes from the vernal Equinoctiall point of the Ecliptique line 143. degrees and 3′2. and therby is found to be in the 23. degree & 3′2. of Leo, againe the star called Spica Virginis in these daies is distant from the first point of Aries 198. degrees, and so is found to be in the eighteenth of Libra.

Why doe you say in these dayes?

Because the fixed starres in processe of time, doe change their Longitude by reason of their proper mooving upon the Poles of the Zodiaque, which is from West to East, for whereas Spica Virginis in Ptolomies time was in the 26. degree of Virgo, it is found now to be in the 18. of Libra, the cause whereof is the precession of the Equinoctiall point or section.

Define what that Precession is.

It is an Arke or portion of the Ecliptique line, contayned betwixt two great Circles, both passing through the Poles of the Zodiaque, in such sort as the one passeth through the first minute of the vernall Equinoctiall point of the said Ecliptique, and the other Circle passeth through the first or former starre of the Rams horne, from which starre the Astronomers doe make all the celestiall motions and revolutions to take their first beginning, and this starre in old time past was knowne to be before the vernall Equinoctiall point, which is the first moment of Aries, but now it is found to haue passed that point so farre towards the Solsticiall point, as in these daies it is knowne to be in the 27. degree, and 4′2 of Aries, and in processe of time it will be cleane out of Aries, and enter into Taurus.

Of the Latitude of the fixed starres.

Cap. 28.

WHat is the Latitude of a starre?

The Latitude is none other thing, but the distance of any starre from the Ecliptique line eyther towards the North or South pole of the Zodiaque, and such Latitude neuer changeth or altereth, for as the starre Spica Virginis is at this present

prefent two degrées diſtant from the Ecliptique line towards the South, ſo it euer hath beene and euer ſhall be, and the like is to be ſaid of all the reſt of the fixed ſtarres, which do alwaies keepe their Latitude, be it Northward or Southward, nære to the Ecliptique, or farre from the ſame.

Of the Declination of the fixed Starres.

Cap. 29.

WHat is the declination of a Starre?

The declination is none other thing, but the diſtance of any fixed Starre from the Equinoctiall, either Northward or Southward, which is mutable as well as the Longitude: for as the fixed ſtarres doe change their Longitudes, ſo alſo by little and little they decline either more or leſſe from the Equinoctiall: As for example, the declination of the ſtarre called Canicula, that is to ſay, the leſſer Dogge in the yeare of our Lord 138. when Ptolomie liued, was 15. degrees 44. ‡ 3″8. towards the South. But in theſe daies the declination of the ſaid ſtarre is but fiue degrees and 7′ towards the South, and by reaſon that the fixed ſtarres in proceſſe of time doe change their Longitude and declination, they are not alwaies vnder one ſelfe ſigne, but doe flit out of one ſigne into another.

How is the Longitude, Latitude, and declination of any Starre to be knowne, and how are the Starres themſelues to be knowne in the firmament.

The Longitude, Latitude, and declination of any Starre is to be knowne moſt truely by the Aſtronomicall Tables calculated of purpoſe, and you may know the ſame alſo without hauing regard to euery ſmall minute, by helpe of the celeſtiall Globe, all the neceſſarie vſes whereof I haue ſet downe in a little Treatiſe to be added hereafter to this Booke, and there alſo I ſhew you how to find out any ſtarre in the firmament that is deſcribed in the Globe. In which Globe are ſet downe as many ſtars as euer were knowne, a few excepted towards the South Pole, which were found out but of late daies, of which ſtarres I ſhall haue occaſion to ſpeake

hereafter in my Treatise of Nauigation. In the meane time I wil proceede to the ascention and descention of the Starres both right, meane, and oblique.

Of the ascention and descention, that is the rising and setting of the Starres as well according to the Astronomers, as according to the Poets.

Chap. 30.

DOe the Astronomers and Poets differ touching this matter?

Yea they differ greatly as well in name as in matter: for whereas of the Poets it is called ortus & occasus Signorum, that is to say, the rising and falling of the Signes, so of the Astronomers it is called Ascentio & descentio Signorum, that is to say, the ascention and descention of the Signes, againe they differ in matter, or rather in manner, for that the Astronomers doe consider the rising and falling of the starres more exactly then the Poets, for the Astronomers doe consider the degrées and minutes of the same, & also do ground their ascention and descention vpon more certaine demonstrations then the Poets. Moreouer whereas the Poets by their manner of rising and falling, doe simply set downe the time of things done, or to be done, the Astronomers doe the same a great deale more exactly, and by their manner of ascention and descention doe consider the increase and decrease of the daies, of which the Astronomicall ascention and descention, I mind here to treate first in generall, and then in particular.

Of the Astronomicall ascention and descention in generall both right, meane, and oblique, and what a giuen Arke is.

Chap. 31.

DEfine what the Astronomicall ascention and descentionis.

Astronomicall ascention is that portion or Arke of the Equinoctiall line which riseth together with some giuen

giuen Arke of the Ecliptique line aboue the Horizon and the descention is that portion of Arke of ꝑ Equinoctiall that goeth down or setteth together with some giuen Arke of the Ecliptique line vnder the Horizon, according to the mouing of the worlo which is from East to West.

What meane you by giuen Arke?

A giuen Arke is as much to say as some supposed portion of the Ecliptique or of any other Circle, as if you would knowe the ascention of some supposed portion of the ecliptique, containing for example 25. or 30. degrees, heere this portion of the Ecliptique containing that nnmber of degrees, is called the giuen Arke, of which Arkes some are called continuall, and some discrete or deuided, which I minde to English here whole and broken, for so I doe Englishe quantitas, continua, & discreta in my Logicke. That Arke is sayde to be continuall or whole which taketh his beginning from the first point of Aries, and so proceeding orderly, endeth at some other degree of the saide Ecliptique. And that Arke is called discrete or broken, which doth not take his beginning from the first point of Aries, but beginneth at some other degree of the Ecliptique, as for example, suppose that it beginneth at the fourteenth of Taurus, and endeth at the fifteenth of Gemini, this Arke is called a deuided or broken Arke, because it doth not begin at the first point of Aries, and so preteerde successiuely: Moreouer you haue to vnder stande that the auncient Astronomers doe commonly make but two kindes of ascention and descention, that is, right and oblique, but there bee in deede three kindes of ascention, that is to saye, right, oblique, and meane ascention.

When is any ascention sayde to bee right, oblique or meane?

It is saide to bee right, when the portion of the Equinoctiall, which riseth or goeth downe together with the Ecliptique, is greater or more in circuit then that of the Ecliptique. And it is sayde to bee oblique, when that portion of the Equinoctiall which riseth or falleth together with the Ecliptique, is lesser then that of the Ecliptique, Againe that is saide to bee meane ascention, when that portion of the Ecliptique which ascendeth, is neyther greater nor lesser then that of the Equinoctiall, for as in

the right Spheare euery quarter of the Ecliptique hath a meane aſcention, and equall to euery quarter of the Equinoctiall, beginning the quarters at any of the foure principall pointes, ſo if you take three ſignes in any other part of the Zodiaque, their aſcentions will not agree with a quarter of the Equinoctiall, ſith there is no one ſigne that doth equally agree with the like portion of the Equinoctiall, and all this matter dependeth vpon the knowledge of the vſe of certaine Circles before defined.

Which be they?

Theſe three, the Zodiaque, the Equinoctial, and the Horizon, for firſt the Zodiaque doth ſhew the place of the Sunne, that is to ſay, in what degree it is of any ſigne, together with the minutes of the ſame, and turning about euery day by the diurnall motion, doth both appeare aboue the Horizon, and alſo is hidden vnder the Horizon. Secondly the Equinoctiall with his equall riſing and going downe, doth meaſure the time of the Sunne whileſt he maketh his abode vnequally and diuerſly aboue the Horizon. Thirdly the Horizon deuideth the one Hemiſpheare from the other, on which Horizon is to be conſidered what Angle any ſigne or ſtarre maketh therewith, in his aſcention or deſcention, and according as any portion of the Ecliptique riſeth or ſetteth rightly or obliquely, ſo in reſpect of the Angle, which it maketh with the Horizon, it is called a right or oblique aſcention or deſcention.

VVhy ſhould the aſcentions & deſcentions bee meaſured rather by the Equinoctial line then by the Ecliptique, ſith the courſe of the Sunne meaſureth all times?

The cauſe thereof is the oblique of the Zodiaque, hauing diuers and variable ſituations, whereby the Sunne abideth ſometimes a great while aboue the Horizon, and ſometimes but a little while, all which inequality is onely to bee meaſured by the Equinoctiall, which is alwaies equally mooued vppon his Poles. Hitherto of the Aſtronomical aſcention and deſcention in general, now of all three aſcentions and deſcentions in particular.

Of

Of the right, oblique and meane ascention in particular, and of the chiefest causes of such diuersitie of ascention.

Cap. 32.

AND for the better vnderstanding of the Astronomicall ascention and descention, wee wil make this diuisiõ, for either it is of some point or Starre, or else of some portion of a Circle chiefly of the Ecliptique line. In the ascention of any point or starre, we consider two things, first what angle it maketh with the Horizon either right or oblique. Secondly the time from the rising of the first minute of Aries, which is the first beginning of the Longitude of any starre or Circle in heauen, and in respect of the Angle euery ascention is said to be right in a right Spheare, and oblique in an oblique Spheare: Againe the time of the ascention is to be measured by the degrees of the Equinoctial from the first minute of Aries, vnto that degree and minute of the Equinoctiall which ascendeth together with the starr. And note by the way that 15. degrees of the Equinoctiall do make an houre, and foure doe make one degree of the Equinoctiall, for foure times 15. doe make 60. minutes, which is an houre. Againe euery ascention considered, according to the time of his gate, is either right, oblique, or meane: if it be right, it is slow: if it bee oblique, it is quicke: if it be meane, it is Equall. Now the ascention of any Arke or portion of a Circle is also either right, oblique, or meane: if it be right, it ascendeth slowly: if oblique, it ascendeth quickely: if meane, it ascendeth equally: And the better to vnderstand all these three kindes of ascentions, I will set downe these twelue rules here following, whereof fiue doe belong to the right Spheare, and seuen to the oblique.

In the right Spheare all the foure quarters rising from the foure principall poincts, haue a meane ascention, and so hath al the foure points themselues.

In the right Spheare all those signes that bee equally distant from the foure principall points haue equall ascentions.

In

3 In the right Spheare all starres or pointes that be in the Solsticial Colure haue meane ascention.

4 In the right Spheare those signes that do ascend rightly, doe descend rightly, and those that doe ascend obliquely, doe descend obliquely.

5 In the right Spheare, Gemini, Cancer, Sagittarius, and Capricornus, doe ascende rightly, and all the rest obliquely.

6 In the oblique Spheare, the two Equinoctiall pointes haue meane ascention.

7 In the oblique Spheare eth halfe of ẏ Spheare, beginning at either of the Equinoxes haue meane ascentiō: but this rule holdeth not, if that you begin any other where.

8 In the oblique Spheare, those signes that do ascend rightly do descend obliquely, and those which ascend obliquely doe descende rightly.

9 In the oblique Sphere, the ascention of any supposed signe is equall to the descention of his opposite signe, and the descention of any supposed signe, is equall to the ascention of his opposite signe.

10 In the oblique Spheare, the ascention of any signe being added to his descention, is equall to the ascention and descention of the same signe being in the right Spheare.

11 In the oblique Spheare euery two signes equally distant from the two pointes of the Equinoctiall, haue equall ascentions and descentions.

12 In the oblique Spheare vnder the Pole Arctique, al signes from Cancer to Capricorne, do ascend rightly, and al the rest obliquely, but contrariwise vnder the Pole Antarctique.

What is the chiefe cause of the diuersity of ascentions and descentions, as well in the right as in the oblique Spheare?

The chiefe cause is the diuersitie of the Angles which the Zodiaque maketh with the Horizon, for the sharper that the Angles be the lesser portion of the Equinocti all riseth together with the Ecliptique, and the righter that the Angles be, the greater portion of the Equinoctiall riseth, but the Equinoctiall by reason of his vniformitie, maketh his Angles alwayes equall one to another, that is to say, in the right Spheare, it maketh right Angles, and inthe oblique Spheare, though not right, yet in euery signe it maketh like Angles.

How

How to know the diuersities of the ascentions and descentions, as well in the right as oblique Spheare.

Chap. 33.

That is to be knowne most exactly by the Tables of ascentions calculated of purpose by Iohannes de Monte Regio, and by Reinholdus called in Latine Tabulæ directionum, and you may know it also without hauing respect to euery minute by marking and obseruing the same in a materiall Spheare or Globe, that hath a standing fote with a firme Horizon, for if you will know the diuersities of ascentions in a right Spheare, then you must lay the Spheare or Globe so as the Horizon may passe through both the Poles, and in turning about with your hand the Equinoctiall, together with the Ecliptique from East to West, marke with what degree of the Equinoctiall any signe begynneth to ascend, & marke that degree of the Equinoctiall with a little peece of waxe, then turne the Globe or Spheare towards the West, vntill the last degree of the said signe doe appeare iust with the vpper edge of the Horizon, and then marke what degree of the Equinoctiall is answerable to the said last degree of the foresaid signe, and there set another peece of waxe, then count the degrees of the Equinoctiall contained betwixt those two marks, and if it be more then 30. that signe is said to ascend rightly, if it be lesse then 30. then that signe ascendeth obliquely, if it be iust 30. then it hath a meane ascention. & by allowing 15. degrees of the Equinoctial to an houre, and 4'. to a degree, you shall know in what time that signe riseth. As for example, if you would know what ascention the whole signe Taurus hath in a right Spheare, and also in what time it riseth, doe thus. First lay both the Poles of the Spheare iust vpon the Horizon, so as the same Horizon may passe through both ỹ poles, then bring the first point of Taurus to the East part of the Horizon, so as it may touch the vpper brimme or edge of the Horizon, and staying it there with your hand, looke what degree of the Equinoctiall doth also touch the Horizon at that instant, which you shall finde to be 27. degrees 54. and marke that degree of the Equinoctiall with a little peece of waxe, or some other thing

that

that may be easily put out or taken away, that done, put forward the foresaid signe Taurus still towardes the West, vntill the last degree of the said signe be ascended vp euen to the vpper edge of the Horizon, and there staying it with your hand, looke againe what degree of the Equinoctiall doth rise withall, which you shall find to be 57. degrees 4′8. and there set another marke vpon the Equinoctiall, then by telling the degrees contained in the Equinoctiall betwixt the two markes, you shall finde the number of degrees to be 29. degrees 5′4. and by allowing 15. degrees to one houre, and 4′. to a degree, you shall find that the whole signe Taurus spendeth in his rising one houre, 5′9. 3″6. But now sith the Meridian in any place (as hath beene said before) doth alwaies shew the right ascention of any starre, signe, arke, or point, because that cutteth both the Equinoctiall and the Horizon with right Angles: you may therefore finde the right ascention of the said signe, or of any other signe or starre without remooving the Spheare from your owne eleuation or Latitude in this manner following, bring the first degree of Taurus close to the mooueable Meridian, and there staying it, marke what degree of the Equinoctiall the Meridian cutteth at that present, which you shall find to be 27. degrees 5′4. which is the right ascention of the first point of Taurus, then hauing brought the last point of Taurus to the foresaid Meridian, marke what degree of the Equinoctiall the said Meridian cutteth at that present, and you shall find it to be the 57. degrees 4′8. now by counting vpon the Equinoctiall, the degrees contained betwixt those two markes, you shall find the number to be 29. degrees 5′4. and you may find the self same number by subtracting the right ascention of the first point of Taurus, out of the right ascention of the last point of Taurus, and thereby you shall know the time of his rising to be the same that you found in the right Spheare. Now if you would know the ascention of any signe in an oblique Spheare, then hauing placed your Spheare according to your Latitude, which for examples sake suppose to be 52. degrees, and that in such Latitude, you would know what ascention the whole signe Taurus hath, and in what time he riseth you must first bring the first degree of Taurus to the East part of the Horizon, so as it may meete euen with the vpper edge of the Horizon, and there staying it, marke what degree of the Equinoctiall

tiall riseth therewith, which you shall finde to bee 12. degrées 4'8. and hauing marked that degree, put forwarde the foresaid signe Taurus towards the West vntill the last degree thereof be ascended vp to the vpper edge of the Horizon, and then make another marke vpon the point of the Equinoctiall, which riseth at that instant with the last degree of Taurus, which you shall finde to be 29. degrées 4'2. and by counting the degrees contained in the Equinoctiall betwixt the two markes, or by taking the lesser ascention out of the greater, you shall find the number of degrees to be 16. & 5'4. whereby you may conclude that the ascention of Taurus in that Latitude is oblique, and that hee spendeth in his rising one whole houre 7',3''6. And look what order is here taught to find out the ascention of any signe, the same order is to be obserued for the finding out of the descention of any signe, sauing that you must seeke for the descention of any signe in the Weste part of the Horizon of the Spheare of the Globe, and not in the East part. As for example, if you would know what descention Taurus hath, & in what time he descendeth in the foresaid Latitude, heere hauing brought the first degrée of Taurus to the West part of ꝑ Horizon, so as it may touch the vpper edge thereof, and hauing also marked what point or degree of the Equinoctiall toucheth the same Horizon at that instant, which you shall finde to bee 42. degrées 3'0. cease not to turne the Spheare or Globe, vntill all the whole signe of Taurus be descended vnder the Horizon, and that the last degrée thereof doe meete iust with the vpper edge of the Horizon, and there stay it vntill you haue againe marked that point of the Equinoctiall, which toucheth the Horizon at that instant, which you shall finde to be 84 degrees 5'4. and by counting the degrees contained betwixt the two markes on the Equinoctiall, you shall find the number of degrees to be 42. degrees 2'4. so as you may conclude, that the descention of Taurus in that Latitude is right, and that he spendeth in his going downe two houres 48'.

How shal I knowe the right or oblique ascention of any of the fixed starres, and also at what houre of the day or night they rise and set, and how long they abide aboue the Horizon: finally when they are at the highest, and when they are at the lowest, called the depression or lowest Meridian Altitude of the starres?

All

All these things are most truely knowne by Tables calculated of purpose, and also they are to be knowne by helpe of the celestial Globe in such manner as shall be declared hereafter when we come to treate of the said Globe.

Of the ascentionall difference and vses thereof.

Cap. 34.

WHat is the ascentionall difference?

It is a portion of the Equinoctiall, whereby is knowne how much the right ascention and oblique ascention of any starre, or portion of the Ecliptique line, or any other point in the firmament, doth differ one from another, As for example in that place where the Pole is eleuated 52. degrees, the right ascention of the first pointe of Taurus is 27. degrees, and 54. and the oblique ascention of the same point is 12. degrees 48. here by taking the lesser out of the greater, that is 12. degrees 48. out of 27. degrees and 54. there will remaine 15. degrees and 6'. which is the ascentionall difference.

What vses hath the ascentionall difference?

The ascentionall difference being knowne, all the oblique ascentions and descentions of the Starres are easily knowne by the Tables of directions, againe by this difference is knowne the increase and decrease of the artificiall day in euery Latitude: therefore it is called of some incrementum diei. Moreouer it sheweth the semidiurnall Arke of the artificiall daye, for in euery oblique Spheare, the artificial day is alwaies either longer or shorter then the Equinoctiall day throughout the yeare, vnlesse the Sunne be in eyther of the Equinoctiall pointes.

How is the increase or decrease of the day to be known by the ascentionall difference?

That shall be declared hereafter in the 50. Chapter of this first booke, whereas we treate of the artificiall day and night, in the meane time we will speake somewhat of the Poeticall rising and setting of the starres.

Of

Of the Poeticall rising and setting of the Starres.

Cap. 35.

DEfine what the Poeticall rising and setting is.

The Poeticall rising is the appearing of some starre aboue the Horizon, determined by the sunne, and the Poeticall setting, is either the going downe of some Starre vnder the Horizon, or else the hiding thereof vnder the beames of the Sunne.

How manifold is the Poeticall rising and setting?

Threefold, that is, Cosmicus, Acronicus, and Heliacus, the signification of which words shall appeare vnto you by the definitions of the foresaid three kindes here following: For ortus Cosmicus, called in Latine mundanus, which is as much to say here as the worldly or morning rising, is when any starre riseth in the morning aboue the Horizon, together with the Sunne, or rather with that point of the Ecliptique line wherein the Sun is at that time. And the Cosmicall setting, called in Latin occasus Cosmicus, is when a starre goeth downe vnder the Horizon at such time as the Sunne riseth, so as this kind of rising and setting is wholly to be referred to the rising of the Sunne.

What is *Ortus* and *occasus Acronicus*.

Ortus Acronicus which is as much to say as the Euening or temporall rising, is when any starre riseth aboue the Horizon in the Euening at the going downe of the sunne: And occasus Acronicus, that is to say, the Euening setting is when any starre goeth downe vnder the Horizon, together with the Sunne, and therefore this kind is alwaies to be referred to the going downe of the Sunne, and not to his rising: And whatsoeuer signe or starre doth rise Acronicè, the same goeth downe Cosmicè, and whatsoeuer starre doth rise, Cosmicè, the same goeth downe Acronicè. And generally all starres that rise in the day time, are said to rise Cosmicè, and all those that rise in the euening after the Sunne set, are said to rise Açronicè.

What

What is *Ortus & occasus Heliacus*.

Ortus Heliacus, that is to say, the Solar rising, is when any starr by departing from the beames of the Sun appeareth, & may be seene, which before being darkned by the Sun could not be seen, And occasus Heliacus, is when any starre by the nigh approching of the Sunne ceaseth to be seene, for by reason that the Sunne by his yearely course & oblique motion of the Ecliptique, doth sometimes approch to diuers starres, and sometime by little and little retireth backe againe from the same, it falleth out that those starres to whom he approcheth, are by nighnesse of his great light darkned and not seene, and by his departing from them, and especially when the sunne is in the East or West part of the firmament, they beginne againe to be seene. And therefore as in the other 2. kinds, the Horizon together with the rising and setting of the Sunne, are to be considered as chiefe causes thereof, so in this last kinde the chiefe cause is to be referred to the nighnesse or farnesse of the Sun from the starre.

Whereto serueth the knowledge of this threefold Poeticall rising and setting of the Starres?

It serueth chiefely to vnderstand thereby those Poets and Historiographers, which in shewing the time of any act done or to be done, doe not set downe the day of the month, but are wont to describe the time by the rising or setting of some notable starr, which they thinke most meete for their purpose, and thereby doe greatly adorne their stile, and specially being poeticall: And because that the times wherein such starres did rise or set, doe greatly differ in these daies from the auncient times. Many therefore of our moderne writers, as Garcæus and others, haue made diuers Tables of purpose to find out the difference, and thereby to come to the true knowledge of the times by the ancient men described, of which matter I leaue to speake, thinking it not meete to trouble young Saylers therewith, for whom I chiefely wrote this Treatise of the Spheare.

Yet some affirme that the auncient men did vse the foresaid poeticall rising and setting of certaine Starres, and specially of the *Pleiades*, *Hiades*, *Orion*, *Arcturus*, *Capella*, and *Lyra*, (which starres were to them best knowne) as a Kalender not onely to know thereby the difference of times, and seasons of the

the yeare: but also by their manner of rising, setting, hiding, and appearing to prognosticate and to fore-see tempests and stormes, yea and that in these daies we also (as some write) might doe the like, though there were neither Kalender nor Ephemerides, and in that respect the knowledge hereof seemeth most necessarie for Mariners.

All such things are to be knowne more exactly by the Astronomicall ascention and descention, then by the Poeticall rising or setting of the starres: And you haue to vnderstand that the Starres since those daies haue changed their places, their longitudes, and declinations, and thereby in diuerse respectes haue altered their Natures and qualities, yea and the very signes themselues: As for example, neither Taurus, Gemini, nor Cancer, is so hoat and drie now, as in times past, neither doth Scorpio cause so much thunder now, as in times past, some againe are more or lesse cold and moyst then they haue beene heretofore, the causes whereof I leaue to the discussing of the Astrologers, and so once againe ende with this matter.

Of time, what it is, and into what parts it is deuided.

Cap. 36.

MOst men that write of the Spheare, after they haue spoken of the ascentions, doe immediately treate of the diuersitie and inequalitie of daies and nightes, but sith daies, nightes, and houres, are but parts of time, like as be weekes, monethes, and yeares, I mind here therefore first briefely to treate of time, and then of all his chiefest parts in order, for if you will be instructed at large of these matters, then reade the booke of Iohannes de sacro busto de anni ratione, and also Iohannes Garceus his booke de tempore.

How define you time?

Leauing to speake of time, without time, that is to say, euerlasting and infinite, called of the Latines Eternitas, ascribed

chiefely to God, and therefore not contained within the moueable Spheares or heauens: I mind to speake here onely of that time which is a number measuring the mouing of the first moueable, and of all other mutable thinges, which time had his beginning with the world, and shall end with the same, & this time consisteth of two parts, that is first, and last, or rather before or after, successiuely following one another, and these two parts are knit together with a common bound called of the Latines Nunc, that is to say now, or at this present, which is the end of that which went before, and the beginning of that which followeth after, & therefore some doe deuide time into three parts, that is, time past, time present, & time to come, but the time present is a moment indiuisible, and is the beginning of time, euen as a point or pricke is the beginning of all Magnitudes, and yet least part thereof it selfe: Againe, time is deuided of some into greater or lesser partes, the greater are such as these: Kalendes, Nones, Ides, a weeke, a month, a peare, the space of fiue peares called of the Romaines Lustrum, and of the Greekes Olympias, the Romaines did call it Lustrum a lustrando, that is to say, of going about, because that they vsed in the end of euery fiue peares, with lights and torches of ware to goe in procession round about the Cittie, and did purge the same by sacrificing a Dogge, a Sowe, and an Ore, and at that time also they did chuse their Dictator in a place called the fielde of Mars, but the space of fiue peares called Olympias, tooke his name of the high mount Olympus in Greece, whereas in the ende of euery fiue peares were celebrated all kinde of martiall playes, as Fencing, Wrestling, Running, and such like in the honour of Iupiter Olympicus, also the space of 15. peares called indictio, in which space those forraine Nations that dwelt farre off, & were tributarie to the Romaine Empire, paid their tributes, that is to say, in the first fiue peares they paide onely golde, in token of their obedience to the Empire: In the second fiue years they paid siluer for Souldiers wages, and in the last fiue peares they paide brasse towards the reparation of armour and munition. Item the space of an hundred peares, called in Latine seculum, and in English an age, whereof the playes that were celebrated in Rome euery hundred peare, were called Ludi seculares, and last of all, the space of a thousand peares, called æuum, containing ten ages, against the

lesser

lesser parts (as Iohannes de sacro Busto saith) are these fiue, the first is called in Latine quadrans, which is the fourth part of a day that is fiue houres, the second punctus, which is the fourth part of an houre in the sunnes account, but in the Moones account the fift part of an houre: the third is called momentum, which is the tenth part of punctus: The fourth is called vncia, which is the twelfth part of momentum: The fift is called Atomus, which is the 48. part of vncia. But because in all the greater parts of time there is no greater variation or difference, then in that which in Latine is called annus, and in English a yeare, I mind here therefore first to treat of a yeare, and then of monethes, weekes, dayes, nights and houres.

Of the yeare, and of his diuers kinds, and of the diuers computations had thereof in diuers ages, and amongst diuers Nations.

Cap. 37.

BE there diuers kindes of differences of yeares?

Yea indeede, but I will speake here only of three kindes or differences, that is of the great yeare, the Solar yeare, and the Lunar yeare, whereof the two last are most necessarie for our purpose.

What is the great yeare?

The great yeare is a space of time in the which not onely all the Planets, but also all the fixed Starres that are in the firmament, hauing ended all their reuolutions doe returne againe to the selfe same places in the heauens, which they had at the first beginning of the worlde: and therefore it is called of some the yeare of the worlde, and of some the great yeare of Plato, which containeth according to Alphonsus, 49000. yeares, whereof wee haue spoken before, yet some affirme that the perfect yeare of the worlde containeth but 36000. yeares whose reuolution is after one degree in 100. yeares, but leauing this matter as not greatly profitable, wee will speake now of the yeare Solar.

Of the sunnes yeare called in Latine *annus solaris*, and of the diuers kindes thereof, and first of the Tropicall yeare, both equall and vnequall.

Cap. 31.

WHat is the yeare Solar?

It is that space of time in which the sunne departing from any point of the Ecliptique line, or from some fixed starre of the Zodiaque, goeth round about the Zodiaque by his owne proper mooving, which is from West to East, and so returneth againe to the selfe same point or starre from which he first departed, and the Astronomers doe make diuers diuisions of the Solar yeare, for first they say that it is either Astronomicall or Politicall: Secondly that the Astronomicall yeare is either Tropicall or Syderall. Thirdly that the Tropicall is either equall or vnequall, which vnequall yeare they otherwise call the apparant yeare, and true yeare, all which kindes haue in a manner one selfe definition, saving that the Tropicall yeare taketh his beginning from the vernall Equinoctiall point, and the Syderall yeare from the former starre of the Rams horne, and doe differ chiefely in quantitie.

Shew then what quantitie, that is to say, how many dayes, houres, and minutes euery such yeare containeth.

The equall Tropicall yeare being counted alwaies from the middle point of the vernall Equinore, containeth 365. dayes, fiue houres, 49. 1″ 5. and 4″ 6. But the vnequall or apparant Tropicall yeare containeth sometime more and sometime lesse then the equall yeare, for sometime besides the 365. daies and fiue houres, it amounteth to 5′ 6. 5″ 3. and 1‴. so as it is more then the equall Tropicall yeare by 7′. 3″ 7. and 1‴ 5. and sometime ouer and besides the foresaide 365. daies and fiue houres, it only containeth 4′ 2. 3″ 8. and 2‴ 7. which is lesse then the equall Tropicall yeare by 6′. and 3‴. which vnequalitie chiefely chanceth by reason of the vnequall precession of the two Equinoctiall points before defined in the 26. Chapter.

Of

Of the Syderall yeare, and how much it containeth.

Chap. 39.



What is the Syderall yeare?

The Syderall or starry yeare is that space of time wherein the Sunne walking vnder the firmament, departeth from the first or foremost starre of the Rams horne, and returning to the same starre againe, which space of time alwaies and equally containeth 365. daies, sixe houres, 9′. and 3″9. so as this yeare is alwaies greater then the Tropicall yeare, and by his equalitie doth alwaies rule and rectifie the inequalitie of the Tropicall yeare.

Of the Politicall yeare, and diuerse kinds thereof.

Chap. 40.



What is the Politicall yeare?

It is a yearely space of time which any people or nation attributeth to the course of the Sunne or of the Moone or of either of them, which is diuers and manifold, according to the diuers customes of the Nations, of all which I meane not to speake at this present particularly, but of certaine speciall and necessarie to be knowne, as of the Iulian yeare, of the Egyptian yeare, of the Iewes yeare, and of the Athenian yeare.

Of the Iulian yeare and why it is so called.

Chap. 41.



What is the Iulian yeare?

The Iulian yeare is that which we vse at this present day which of all other yeares maweth nigheſt vnto the Tropicall yeare, for this yeare consisteth of 365

daies and fiue houres, which fiue houres, if it should be reckoned euery yeare, it would make a great confusion, and therefore it is reckoned at the end of euery fourth yeare, which yeare consisteth of 366. daies, for foure times fiue doth make 24. houres, which is one whole naturall day, wherof that yeare is called the leape yeare, And thereby the Julian yeare is said to be twofold, that is common, containing 365. daies, & the other bissextile or leape yeare, containing 366. daies. This word bissextile is derived of bis and sextus, because the sixth day next before the Kalends of March is twice repeated or reckned, which indeede is the 25. of Februarie, vpon which day the feast of Saint Mathias commonly falleth.

Why was it called the Iulian yeare?

Because Iulius Cæsar the first Monarch of the Romaine Empire caused the yeare (according to the course of the Sunne) to be reduced to the number of daies and houres before expressed, who brought an excellent Astronomer with him at his comming from Egypt, as well for that purpose, as to teach the Mathematicall disciplines vnto the Romaines, yet you haue to consider that the Julian yeare being greater then the Tropicall yeare, doth cause great diuersitie in that it maketh as well the Equinoctiall and Solsticiall points, as also the entrance of the Sun into the other signes by little and little to anticipate or to runne before, for whereas in Iulius Cæsars time the vernall Equinox was the 23. day of March, the same Equinox is now about the 11. day of March which is sooner by 12. daies.

Of the Egyptian yeare, and how many daies it containeth.

Cap. 42.

THe Egyptian yeare containeth the iust number of 365. daies, by reason of which equalitie this yeare is very fit to serue the Astronomers turne in making their Astronomicall computations, but the Egyptian yeare hath no certaine place of beginning: For by omitting the fiue houres which is in the Julian yeare, it doth anticipate in the space of 4. yeares

one

one whole day in such sort, as 1460. Julian yeares do make of the Egyptian yeares, 1461.

How many Moones the Iewes yeare, and the Athenians yeare doth containe.

Cap. 26.

THe Iewes yeare contayneth for the most part twelue Moones, and sometime thirteene Moones, which kinde of yeares did agree with the yeares of the Greekes, and of the Athenians, and also of the ancient Romaines before Iulius Cæsars time: and the auncient Romaines did begin their yeare from March, but the latter Romaines frō the winter Solstice. Againe the Iewes did beginne their yeare at the first new Moone that followed next after the vernall equinor: But the Athenians began their yeare at the new Moone that followed next after the Summer Solstice: The most people of Asia began their yeare at the autumnall Equinor: But the most part of those that dwell in these parts of the world, following the Custome of the Romaine Church, doe begin their yeare at the Kalends of January, which in old time was not much distant from the Winter Solstice, which Solstice at Christs birth was the 25. of December, but now the same Solstice is about the twelfth day of December, so as the Winter Solstice falleth sooner by thirteene daies then it did at that time. But we heere in England doe begin the yeare at the 25. of March.

Of the yeare Lunar, and of the kindes thereof.

Chap. 44.

HOw many kindes of Lunar yeares be there, and which be they?

Of Lunar yeares there be two kindes, whereof the one is ordinary, called in Latine Annus communis, and the other extraordinarie or excessiue, called by a Greeke name Emboliſmalis, The ordinary

dinary or common yeare, is the space of twelue Moones or changes, passing by course within the yeare Solar, and is called common, because it hath twelue Moones Lunar, euen as the Solar yeare hath twelue monthes Solar, and consisteth of 354. daies and a little more, so as the Solar yeare exceedeth the Lunar yeare by 11. dayes, for the yeare Solar containeth (as hath beene said before) 365. dayes, in which account the Fractions in both yeares are omitted: And therefore if these two yeares should begin together at one selfe time, the Lunar yeare would end his course sooner by 11. dayes then the yeare Solar.

What is the extraordinarie Lunar yeare called Embolismalis?

It is the space of thirteene Moones or changes containing 384 dayes, so as this yeare exceedeth the common Lunar yeare by 30. dayes, and is more then the yeare Solar by 19. daies.

Of the diuers kinds of monthes, and into what parts euery Solar moneth is deuided according to the Romans, that is, into Kalands, Nones, and Ides.

Cap. 45

HOw many kindes of monethes be there and which be they?

There be three kinds, that is, the month Solar the moneth Lunar, and the moneth Vsuall.

The month Solar is that space of time which the sun spendeth in passing through any one of the 12. signes.

The Lunar month is that space of time which the Moone spendeth, while she departing from the Sun returneth to him againe.

The vsuall month is that number of dayes which are set downe in our common Kalenders, whereof some containe thirtie dayes, some thirtie and one, and the moneth of Februarie hath but 28. dayes. But if you will readily know which containe more dayes and which lesse, keepe alwayes in memorie these old English verses here following.

Thirtie

Thirtie dayes hath November,
Aprill, Iune, and September:
Februarie hath 28. alone,
And all the rest hath thirtie and one.

But when it is leape yeare, Februarie hath 29. dayes. Againe ỹ Romaines deuided the Solar moneth into Kalenders, Nones, and Ides.

VVhat be Kalends?

The Kalends are the first day of euery moneth from which the Romaines counted the dayes of the moneth proceeding backward As for example, the first day of Aprill they named the Kalends of Aprill, and the last day of March next before they called in Latine pridie Kalendas Aprilis, that is, the daye before the Kalends of Aprill, and the next day before that the third Kalends, of Aprill, and the next day before that the fourth Kalends, and so forth vntill they come to the Ides.

VVhereof sprang this name Kalends?

Of the Greeke verbe Calo, which is as much to say as call, for the first day of euery month ỹ cryer standing in a high place made foure cals or more to signifie thereby to the people howe manye dayes in that month the Faires or Markets called Nundinæ should endure, and of Nundinæ sprang this word Nonæ, that is to say the dayes of the faires: For looke how many Nones there were in euery moneth, so many faires there were, during which time the Romaines neuer worshipped any God because there was no holy day during that time, and therefore Ouid saith that Nonarum tutela Deo caret, that is to say, no God had tuition of the Nones.

VVhat are Ides?

They are those dayes by which the Nones are deuided from the rest, and these Ides doe deuide in a manner the whole moneth into two equall parts, for the first Ides most commonly falleth either on the 13. 14. or 15. day of the moneth.

How many Ides, Nones, and Kalends do belong to euery moneth.

Of Ides euery month hath eight, but of Nones, March, May, July, and October, haue fiue and all the rest of the moneths haue

but

but foure Nones, but they differ most in the number of Kalends, as you may perceiue by this Table following, which sheweth how many Kalends, Ides, and Nones, doe belong to euery moneth. Thus farre of the moneth Solar, now I will speake of the month Lunar.

The Table.

Monethes.	Kal.	Ide.	None.	Monethes.	Kal.	Ides.	None.
Ianuarie.	19	8	4	Iuly.	17	8	6
Februarie.	16	8	4	August.	19	8	4
March.	17	8	6	September.	18	8	4
Aprill.	18	8	4	October.	17	8	6
May.	17	8	6	Nouember.	18	8	4
Iune.	18	8	4	December.	19	8	4

Of the diuers kindes of moneths Lunar.

Chap. 46.

HOw many kinds be there, and which be they?

Iohannes de Sacro Busto sayth, that there bee foure kindes, that is the moneth of paragration, the moneth of Apparition, the moneth medicinall, and the moneth of consecution.

The month of Paragratiō, is that space of time in which the Moone departing from any one point of the Zodiaque, goeth by her proper mooving about the Zodiaque, and returneth againe to the said point from which she first departed, which her reuolution is accomplished in 27. daies and 8. houres. And this reuolution of some is called a yeare, and by this account the Moone tarrieth in euery signe two daies fiue houres and 2′9.

The moneth of Apparition consisteth of 28. daies, deuided commonly by foure weekes, euery weeke containing seuen dayes, for foure times seuen maketh 28. of which foure weekes the first

is

is counted from her first apparance vnto the ende of the seuenth day, and so forth from weeke to weeke, so as the fourth weeke endeth at the 28. day, in which account the odde houres during the Moones abode vnder the beames of the Sunne, when as she is said to be combuste, are not reckned.

The moneth Medicinall containeth but 26. daies, and a halfe (as Galen saith) and is deuided also into foure weekes, the diuision being made by minutes.

The moneth of Consecution is that space of time wherein the Moone being in coniunction with the Sunne, goeth about her Circle and returneth againe to the same point, and not finding the Sun there because he hath in that while passed through one whole signe, she hasteth after, and in two daies and foure houres 44. and a little more she ouertaketh the Sunne, and is againe with him in coniunction, of which her following and ouertaking the Sunne, this moneth is called the moneth of Consecution, which moneth consisteth of 29. daies and a halfe: during which time as the Sun by his owne proper course passeth through one signe or thereabouts, so the Moone by her course in the selfe same time passeth through the whole Zodiaque and one signe more: And note by the way that the Sunne in making his owne proper course doth not enter into any signe in the very beginning of any moneth, but rather about the midst of euery moneth, or at the least not much ouer or vnder that day.

Of a Weeke,

Chap. 47.

NOw because that euery month as well Solar as Lunar is deuided into foure weekes, I will speake somewhat of a weeke.

What is a weeke?

A weeke called most commonly in Latine Septimana, which is as much to say as seuen mornings, is the space of seuen daies, whereof the first is called Sunday, the second Munday and so forth to Saturday,

turday, which names the Gentiles gaue to these seuen daies in honour of the seuen Planets whom they worshipped as Gods, for they called the first day the day of the Sunne, the second the day of the Moone, the third the day of Mars, the fourth the day of Mercury, the fifth the day of Iupiter, the sixth the day of Venus, the seuenth the day of Saturne.

Are there any more names belonging to this word weeke?

Yea, it is called also by a Greeke name Hebdoma, that is to say, containing seuen daies, and in the Scripture it is called sometime Sabbatum, as when the Pharisie said that he fasted Bis in Sabbato, that is to say, twice a weeke, for the Iewes called Sunday the first of the Sabbaoth, and Munday the second of the Sabaoth, and so forth in order vntill Saturday, which in deede was their true Sabaoth or day of rest.

Why is it not still so counted amongst vs Christians, but changeth into Sunday?

For two causes, first to auoide the superstition of the Iewes, and partly it was done in the honour of Christ, whose day of birth, resurrection, and sending of the holy Ghost, was on the Sunday.

Of daies and nights both naturall and artificiall.

Cap. 48.

THe Astronomers doe deuide the daies into two kindes, whereof the one is called naturall, and the other artificiall.

VVhich call you a naturall day?

A naturall day is one entire reuolution of the Equinoctiall aboue the earth, whereunto must be added such portion of the Zodiaque, as the Sunne in the meane while maketh by his proper motion, which is from West to East.

In what time doth the Equinoctiall euery day make his reuolution?

In 24. houres, which space containeth both day and night, according to which reuolution and number of houres, the most part of Horologies or clockes in the East countryes doe goe, and are set to shew the houres of the day, but yet diuersly, for some begin their

their naturall day at the rysing of the Sunne, as the Bohemians and the Persians, and some at the going downe of the Sunne, as the Italians the Atheinans, the Iewes, the Egiptians, and the Arabians, but the Astronomers recken their naturall daye from noontide to noontide.

If the equinoctial doth make his reuolution iust in 24. houres, then all naturall dayes are equal.

That is true if ye onely consider the motion of the Equinoctial, but if you adde thereunto (as I sam before) that portion which the Sunne in the meane while maketh by his owne proper motion, you shal find them to be vnequall, because that portion is sometime more, sometime lesse, according to the swift or slow ascention of the signe wherein the Sunne is.

What is the artificiall day?

It is the distance or space that is betwixt the rising of the Sun, and going downe of the same.

The causes why the time betwixt the rising & going down of the Sunne is vnequall.

Cap. 49.

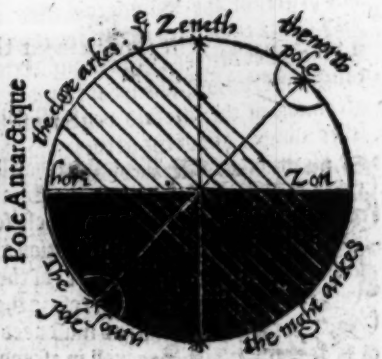
IT must needes bee vnequall, because the abode of the Sun aboue the Horizon is variable, as well for the vnequall ascention and descention of the signes, as also for the obliquitie of the Horizon and Zodiaque: and therefore the spaces of the artificiall dayes must needes be vnequall: for the Sun as well in ascending from the beginning of Capricorne, to the beginning of Cancer, as also in descending from the beginning of Cancer to the beginning of Capricorne, describeth on eche part 182 Circles or Paralels, the middemost whereof is the Equinoctiall. All which Paralels are deuided into two parts by the Horizon, and the Arkes which are aboue the Horizon are called the artificiall dayes, and the Arkes beneath the Horizon are called the artificiall nightes, which Arkes to those that dwell vnder the Equinoctiall in a right Spheare are alwaies equall, that is to say, the diurnall Arke is equall to the nocturnal, because

because their Horizon passeth through the Poles of the world, but to those that dwell in an oblique Sphere, about whose Horizon the Pole is any thing elevated, bee it never so little, the Arke or Paralels are unequall one to another, that is to say, either making short daies and long nights, or else long daies and short nights, the Equinoctiall only excepted, which as well in the oblique Sphere as in the right, is always devided by the Horizon into two equall partes, and so maketh the dayes and nights equall in all places of the world. All which thinges you shal easily comprehend by these two figures following, whereof that on the left hand representeth the right Sphere, and the other on the right hand representeth the oblique Sphere.

A figure of the right Sphere.



A figure of the oblique Sphere.



And here I thinke it not amisse to shewe you howe to finde out the length of every artificiall day and night throughout the yeare in every Latitude by the materiall Sphere, and likewise howe to know at what parte of the Horizon the Sunne riseth and setteth every day, and also how to finde out his Meridian Altitude, whereby you shall know how nigh or how farre from your Zeneth he is every day.

How

How to find out by the materiall Spheare or Globe, & by help of the ascentionall differēce before defined, the increase and decrease of euery day throughout the yeare in euery seuerall Latitude, and at what houre the Sunne riseth and setteth.

Cap. 27.

FIrst hauing set the Sphear at your Latitude, learne to know by some Table or instrument in what signe and degrē thereof the Sunne is at such day of the moneth and yeare as you seeke, and bring that degrē close to the mouable Meridian, & there marke in what point or degrē the said Meridian cutteth the Equinoctiall, and what number it hath, for so shall you haue the right ascention of the degree of the Sunne for that day. That done, bring the said degree of the Sunne to the East part of the Horizon, so as it may meete euen with the vpper edge thereof, and staying it there, marke what degree of the Equinoctiall at that instant doth also touch the Horizon, and what number it hath, & that is the oblique ascention of the foresaid degree of the Sunne, then subtract the lesser number out of the greater, and that which remaineth shall be the ascentionall difference, as for example, in this present yeare 1590. the xi. day of Aprill the Sun is in the first degree of Taurus, whose right ascention in the Latitude 52. by doing as before is taught, you shall find to be 27. degrees and 54. and the oblique ascention thereof to be 12. degrees 48. and the ascentionall difference to be 15. degrees, 6'. which difference you must first double, and then conuert the same into houres and minutes by allowing 15. degrees to an houre, and 4'. to a degree, that done, adde those houres and minutes to the Equinoctiall day, which is alwaies 12. houres, and the summe of that addition will shew you the length of the day, when the Sun is in the first point of Taurus, which is 14. houres & 12. and that is the true length of the day. But you haue to note by the way that as you haue to adde the sum of the houres to the Equinoctiall day, the Sun being in any of the 6. Northerne signes, so must you subtract the said houres from the Equinoctiall day, the Sunne being in any of the six Southerne signes. As for example, suppose the Sunne to be in the first point of Scorpio,

the

the right ascention whereof is 207. degrées 5′4. and the oblique ascention is 223. degrées, here by taking the lesser out of the greater you shall find the ascentionall difference to be 15. degrées 6′. which being doubled, maketh 30. degrees and 1′2. that is two houres and 1′2. which if you subtract from 12. there will remaine 9. houres 4′8. which is the length of the artificiall day, when the Sunne is in the first degrée of Scorpio, the one halfe whereof is called the semi-diurnall Arke of that artificial day, which is 4. houres 54. minutes, whereby you may gather that the Sun at that time riseth foure minutes after seuen of the clocke, and setteth againe foure minutes before fiue, so likewise in the former example where the ascentionall difference was 15. degrées fiue minutes, which being doubled made 30. degrées and 1′2. that was two houres and 1′2. which being added to 12. houres made 14. houres and 1′2. the halfe whereof is seuen houres and fiue minutes, whereby you may gather that the Sunne did then rise 6′. before 5. of the clocke in the morning, & did set 6′. after 7. of the clocke in the Euening, and so you haue both the forenoone and afternoone of the day, which two times are best to be reckoned alwaies from 12. a clocke at noone, that is to say, the forenoone houres & minutes from twelue backward, and the afternoone houres and minutes from twelue forward, and by subtracting the whole length of the artificiall day from 24. houres, you shall haue the length of the artificiall night, as in the former example take 14. houres & 1′2. from 24. houres, and there will remaine for the length of the artificiall night nine houres and 4′8.

How to know by the materiall Spheare or Globe, in what part of the Horizon the Sunne riseth and setteth euery day, and thereby the length of the day. Also how to know the Meridian altitude of the Sunne euery day throughout the yeare, and being at his Meridian altitude, to know how farre distant he is from the Zenith euery day.

Cap. 51.

FIrst then hauing set the Spheare or Globe at your Latitude, which suppose to be 52. degrées, bring the degrée of the sun for that day, to the East part of the Horizon, so as it may méete iust with the vpper edge thereof, & there

there set a little peece of ware vpon the Horizon, that done, turne the said degree of the Sunne to the West part of the Horizon vntill it meete againe with the vpper edge of the Horizon, and there set another peece of ware vpon the Horizon, and those two markes will shew you in what part of the Horizon the Sunne riseth and setteth: As for example, I would know this present yeare 1594. in what part of the Horizon the Sunne doth rise & set the twelfth of June, here finding by the Ephemerides that the Sun is entred 26. into Cancer at that day, I bring that point of the Ecliptique to the East part of the Horizon, so as it may meete iust with the vpper edge thereof, and there I set a little peece of ware vpon the Horizon: that done I turne the said point of the Ecliptique to the West part of the Horizon, and whereas that pointe toucheth the vpper edge of the said Horizon, I set there another peece of ware vpon the Horizon, then counting the degrees vpon the Horizon from the true East point thereof to the first peece of ware Northward, I finde the number of degrees to be 40. degrees or thereabouts, which containeth three points and a halfe and somewhat more, of the Mariners Compasse, whereby I gather that the Sun riseth at that time very neere to the Northeast, and setteth neere to the Northwest, because the number of the degrees in both parts of the Horizon are like.

How shall I know how many points of the Mariners Compasse are contained in any number of degrees, exceeding the number of degrees and minutes contained in one point?

The Mariners Compasse containeth 32. points, and euery point containeth 11. degrees and ¼ of a degree which is 15. minutes, wherefore whensoeuer you would know how many points of the compasse are contained in any number of degrees, be it great or small, multiply that number by foure, and deuide the product thereof by 45. & the quotient will shew the number of the points, and if there be any remainder, the because the Mariner doth make euery point to haue foure quarters, multiply that remainder by foure, and deuide the product by 45. which is the common Diuisor, and the quotient will shew the quarters, or if the remainder be but small, then multiply that remainder by eight, which are halfe quarters, and deuide the product thereof by 45. as before, and the quotient will shew the halfe quarters of a point: As in the former

example in multiplying 40. degr. by 4. the product is 160. which if you deuide by 45. you shall find in the quotient 3. whole pointes, and the remainder to be 25. which being multiplyed by 4. the product will be 100. which if you deuide by 45. you shall finde in the quotient 2. quarters of a point, & the remainder to be $\frac{10}{45}$ of a quarter, that is to say, if you can deuide one quarter in 45. parts, then you must take 10. of those parts, & adde thē to the former summe, which being of small importance is not to be regarded. But now to returne to my first matter, I say, that by counting the degrees vpon the Horizon, from the first peece of ware to the South point of the Horizon, I find the number of degrees to be 130. degrees, & by allowing 15. degr. to an houre, I find the halfe day to containe 8. houres 10'. which being doubled maketh 16. houres 20'. Then to know the Meridian altitude of the Sun, you must bring the degree of the sunne right vnder the Meridian, and the number of the degrees contained in the Meridian betwixt the South point of the Horizon, and the said degree of the Sunne will shew the Meridian Altitude of the Sunne, so shall you finde the Meridian Altitude of the Sunne being in the first point of Cancer to be 61. degrees, which once had, the distance from the Zenith is soone knowne: for if you subtract 61. degrees from 90. you shall find the distance of the Sunne from the Zenith to be 29. degrees. Againe, contrariwise the distance from the Zenith being subtracted from 90. the remainder will shew the Meridian Altitude, for those two numbers being added together, doe alwaies make a iust quarter of the great Circle, which is 90. degrees.

Of houres as well equall as vnequall, and into what partes they are deuided.

Chap. 52.

AS of daies and nights there be two kinds, that is naturall & artificiall before defined, so likewise are there 2. sorts of houres, that is equall, and vnequall: An equall houre is the 24. part of a naturall day, and euery such houre containeth 15. degrees of the Equinoctiall, for 15. times 24. maketh 360. degrees, which is the whole

whole circuit or Longitude of the Equinoctiall, which according to the diurnall mouing of the first mouable maketh his reuolution in 24. houres as hath beene said before, and therefore this equal houre is also called an Equinoctial or natural houre. The vnequal houre is the twelfth part of an artificiall day or artificiall night, which daies and nights as they be sometimes long and sometimes short, according to the time of the yeare, so are the houres of the same. For both day and night, be it neuer so short, is deuided by the Astronomers into twelue houres, so as when here in some part of England towards the North the artificial day is 17. houres long, and the night but seuen houres, if you deuide either of these into twelue parts, you shall find that euery such twelfth part of the day shall containe more then the naturall or Equinoctiall houre by 25 and the twelfth part of the said artificiall night to containe but the one halfe of an equall houre and fiue minutes, which notwithstanding being both added together, will make in all 24. equall houres, which is a naturall day, so as by this meanes you may easily perceiue that a naturall day, comprehendeth both kindes of houres, as well vnequall as equall. Note also that the vnequal houres are called somtime artificiall and somtime temporall houres, artificiall, because they are dayly changed by the varietie of the artificiall dayes and nights, and are neuer equal but twice in the yeare, when the Sunne is in either of the Equinores: and they are called temporall, because the auncient obseruers of time were woont to make diuers clockes and Horologies to shewe these vnequall and temporall houres, of which clockes there are yet some to be seene at this day. Moreouer the houres both equall and vnequall are deuided not onely into quarters of houres, but also into minutes, for euery houre be it long or short, is deuided into 60. minutes, and euery minute into 60. seconds, and euery second into 60. thirdes, and so forth to fourthes, fifts, sirthes, and into as many as you will, so as you make your diuision alwaies by 60. But you haue to note, that as the Astronomers doe deuide the artificiall daye and artificiall night into houres both equall and vnequall, so the Iewes doe deuide each of them into foure quarters, in manner and forme following.

How and in what manner the Iewes doe deuide the artificiall day and night, eech of them into foure quarters.

Cap. 53

THey deuide the Artificial day into four quarters, by allowing to euery quarter 3 houres, accounting the first houre of the first quarter at the rysing of the Sunne, and the third houre of the said quarter they called the third houre, and the third houre of the second quarter they called the sixth houre, which was midday or noontide, againe they called the third houre of the third quarter, the ninth houre, and they called the second houre of the fourth quarter, the eleuenth houre, and they called the last houre which was the twelfth houre of the day, euentide, because then the sunne went downe.

Whereto serueth the knoweledge hereof?

By knowing this account you may the better vnderstande certaine places of the Scripture making mention of thinges done at certaine houres not like vnto our common houres. For whereas it is saide in the Gospell of Saint Iohn, that Christ healed the Rulers sonne that was sicke of an Ague in Capernaum, and that the Ague left him the seuenth houre, is as much to say, as the Ague left him at one of the clocke in the afternoone: Againe whereas mention is made in the Gospell of S. Mathew, of the labourers that came towoorke in the Vineyard at the eleuenth houre is to bee vnderstoode at fiue of the clocke in the afternoone, or rather one houre before the sunne set, for you muste thinke that the Sunne ryseth not, nor yet goeth downe in Iewrie alwaies at sixe of the clocke, for then they should haue no artificiall day nor night, but all dayes and nightes should bee alike. Also they deuided the artificiall night into foure quarters otherwise called by them the foure watches of the night, for the first three houres was the first watch, during which time all the Souldiers both yong and olde of anie fortified Towne were wont to watch. the second three houres they called the second watch, which was about the dead of the night, at which time the yong Souldiers onely watched, and the thirde

quarter

quarter of the night containing also three houres, and was called the third watch the Souldiers of middle age did watch, and the last three houres called the 4. watch which was about the breake of day, the old Souldiers onely watched. But now because the auncient Astronomers doe appoint the gouernment of the vnequall houres to the seuen Planets, it shall not be amisse to shew you here what Planet raigneth euery houre both day and night.

How to know what Planet raigneth in euery houre of the day or night artificiall, as well by helpe of a Table, as by a rule contained in one verse.

Chap. 54.

BEt first I wil describe vnto you the Table, and then briefly set downe the vse thereof. In the first collum of this Table on the left hand are set downe the seuen daies of the weeke, whereof the first is Sunday, and the second Munday, and so forth downeward to Saturday, against euery which day the Planets are placed towardes the right hand, euery one in course one after another, & in the first row of this Table which is the head or front thereof, are placed the houres of the day written in Arithmeticall figures, & in the next row of the said front, are set downe ỳ houres of the night written as you see in common numerall letters.

The Table,

Houres of the day.	1	2	3	4	5	6	7	8	9	10	11	12		
Houres of the night.	iii	iiii	v	vi	vii	viii	ix	x	xi	xii				
Sunda.	☉	♀	☿	☽	♄	♃	♂	☉	♀	☿	☽	♄	♃	♂
Mund.	☽	♄	♃	♂	☉	♀	☿	☽	♄	♃	♂	☉	♀	☿
Twesd.	♂	☉	♀	☿	☽	♄	♃	♂	☉	♀	☿	☽	♄	♃
Wedn.	☿	☽	♄	♃	♂	☉	♀	☿	☽	♄	♃	♂	☉	♀
Thursd.	♃	♂	☉	♀	☿	☽	♄	♃	♂	☉	♀	☿	☽	♄
Friday.	♀	☿	☽	♄	♃	♂	☉	♀	☿	☽	♄	♃	♂	☉
Saturd.	♄	♃	♂	☉	♀	☿	☽	♄	♃	♂	☉	♀	☿	☽

The vse of the Table.

Now the vse of the said Table is thus: whensoeuer you would know in what houre of the day or night any Planet raigneth, you must first seeke out the houre of the day or night, and if it be of the day, then you shall find it in the first row of the front, if of the night, in the second row of the front, as hath beene said before: & from that houre descend with your finger to the common Angle standing right against the day which you seeke, & that will shew you what Planet thē raigneth. As for example, if you would know on Wednesday at 8. of the clocke of the day what Planet raigneth, then hauing found the number of 8. in the front, written in Arithmeticall figure, come straight downe from thence with your finger to the common Angle standing right against Wednesday, and you shall find that Mercurie raigneth. And if you would know what Planet raigneth the same day at the eight houre of the night, then descend from the houre of the night downe to the common Angle, and you shall find that the Sunne raigneth, and so forth of all the rest.

The rule contained in one verse, and the vse thereof.

The rule in verse is thus:

Sol, Ve, Mer, Luna, Saturnus, Iupiter, & Mars.

These vii. words (the coniunction & being left out) doe signifie the seuen Planets: For Sol is the Sunne, Ve standeth for Venus, Mer for Mercurius, Luna is the Moone, and the other three Planets following, as Saturnus, Iupiter, and Mars, doe make vp the number of seuen, which must alwaies follow one another, in such order as they are here set downe in the foresaid verse, and to haue the true vse of this rule, you must first apply euery Planet to his owne proper day, as Sol to Sunday, Luna to Munday, Mars to Tuesday, Mercurius to Wednesday, Iupiter to Thursday, Venus to Friday, and Saturnus to Saturday: for euery one of these Planets gouerneth the first houre of his owne proper day, and the Planet placed next to him in the verse, gouerneth the second houre of the same day, and so forth orderly, as for example, if you would know what Planet shall raigne on Sunday at the third houre of the day, you must first say that Sol doth raigne the first houre be-

cause

cause that is to day, and Venus raigneth the second houre, and Mercurie the third houre according to your rule, and so by keeping the order of the verse, you shall easily appoint to euery houre both of the day and of the night, artificiall his owne gouernour: For though both day and night be deuided ech of them into 12. houres, making in all 24. houres, and that there be but seuen Planets, yet by appointing euery Planet to his owne proper day as gouernor of the first houre of the same day, and by obseruing the order of the verse in repeating the said Planets, you shall not faile to giue to euery houre his proper Planet. Thus hauing sufficiently spoken of the celestial part, I will now proceede to the Elemental part of the world, contained in the second Booke of this Treatise.

The ſecond part of the Spheare.

Of the Elementall part of the world. Cap. 1.

WHat doth the Elementall part containe? I told you before that as the celeſtiall part doth containe the eleuen heauens before deſcribed, ſo the elementall part containeth the 4. Elements, that is to ſay, fire, Aire, Water, and Earth, which are of them ſelues pure ſubſtances, and the firſt and next beginnings whereof all mixt bodies are compounded, and therfore not to be ſeene with our out ward eyes, for as we our ſelues are bodies compound, ſo with our outward ſences we can diſcerne nothing but that which is compound: and therefore the fire, aire, water or earth which we dayly feele or ſee, are not the Elements themſelues, but things compounded of them. The natures & properties of which Elements I minde here but briefly to touch, ſith the exact handling thereof belongeth rather to naturall Philoſophers and to Phiſitians, then to Geographers, who haue to deale only with the ſituations of ỹ earth, with Zones, Paralels, Climes, Longitudes, Latitudes, diſtances and ſuch like thinges belonging to the meaſure & deſcription of this earth here which we inhabite.

Define theſe Elements.

Of the Fire, and of his nature and motion. Chap. 2.

THe Fire is an Element moſt hoat and drye, pure, ſubtill, and ſo cleare as it doth not hinder our ſight looking through the ſame towards the ſtars, and is placed next to the Sphere of the Moone, vnder the which it is turned about like a celeſtiall Spheare.

Of

Of the Aire and into how many Regions it is deuided? Cap. 3

NExt to the fire is the Aire which is an Element hotte and moyst, and also most slyrible, pure and cleare, notwithstanding it is farre thicker & grosser as some say, towards the Poles then elsewhere, by reason that those parts are farthest from the sun: And this Element is deuided of the naturall Philosophers into three Regions, that is to say, the highest Region, the Middle Region, and the lowest Region, which highest Region, being turned about by the fire, is thereby made the hotter, wherein all fierie impressions are bred, as lightnings, fire drakes, blazing starres and such like.

The middle Region is extreame cold by contra opp osition, by reason that it is placed in the midst betwixt two hotte Regions, & therefore in this Region are bred all cold watry impressions as frost, snow, ice, haile, and such like.

The lowest Region is hotte by the reflexe of the Sunne, whose beames first striking the earth, doe rebound backe againe to that Region, wherein are bred clouds, dewes, raines, and such like moderate watry impressions, which three Regions of the aire with the rest of the Elements this figure doth plainely shew.



Of the Water, and whether it be round or not.

Chap. 4.

NExt to the Aire, is the Water, which is cold moyſt, and flurible, and being lighter then the Earth would of his owne nature ſurmount and couer the whole earth, had not God in the creation of the world deuided waters from waters (as the Booke of Geneſ. ſaith) and gathered together thoſe waters that are vnder the firmament into certaine concauities of the earth, leauing other parts of the earth dry, and diſcouered, that man and beaſt might inhabite the ſame, and haue foode neceſſarie for their behoofe, ſo as now both Water and earth doth make one entire and Spheticall body, which is enuironed with the Aire.

Is not the Water a rounde body of it ſelfe without the earth?

Many late writers doe deny the whole body to be round, affirming onely the Conuexe ſuperficies or vpperface of the water to be round, for (ſay they) the earth being not altogether round, the Concaue ſuperficies of the water cannot be round, notwithſtanding the moſt part of the auncient writers doe affirme the whole body of the water to be rounde, ſaying that the water hath the like ſhape in his whole, that it hath in his parts: For the parts which are drops, are round, ergo the whole is round. Againe they proue the water of the ſea to be round by demonſtration thus. ſuppoſe a ſhip to depart from the ſhore whereon ſome marke is ſet, which you may ſée with a right leauelled line ſtanding at the ſterne of the ſaid ſhip, but ſaying further from the ſhore, you cannot ſee the marke any more ſtanding vpon the ſterne, but ſhall be faine to goe vp to the toppe of the Maſt to ſee it, by reaſon that the water being a round body riſeth and ſwelleth in the midſt, and ſo letteth your ſight as this figure plainely ſheweth.

Of



Of the Earth and whether it be all round or not.

Cap. 5.

NExt to the Water is the Element of the Earth, which of his nature is thicke, heauy, cold, dry, and not flurible as is the water & aire, but is firme & apt to kæpe his place, & though ſome deny the earth to be rounde becauſe of the high mountaines, and deepe dales and vallies therin, which are nothing in compariſon of the whole earth to alter that roundnes which it hath by nature, yet Ariſtotle affirmeth in his ſecond Booke de cœlo & mundo, the fourteenth Chapter, that the earth of her owne nature is rounde, prouing þ ſame as well for that the Moone when ſhe is eclipſed in part, could not haue ſuch horned ſhape as this figure repreſenteth.



Unleſſe the earth were alſo round by the interpoſition whereof ſhe is Eclipſed, either totally or in part as hath beene ſaid before. Againe he prooueth the roundnes of the earth by the altering of the Horizon, for in going from North to South, our Horizon altereth in ſuch ſort as we diſcouer thoſe ſtarres which we could not ſee before, but were cleane hidden from our

our sight, some also deny that ẏ earth is in the middest of the world, and some affirme that it is moueable, as also Copernicus by way of supposition, & not for that he thought so indeede: who affirmeth that the earth turneth about, and that the sunne standeth still in the middest of the heauens, by helpe of which false supposition he hath made truer demonstrations of the motions & reuolutions of ẏ celestiall Spheares, then euer were made before, as plainly appeareth by his booke de Reuolutionibus, dedicated to Paulus Tertius the Pope, in the yeare of our Lord 1536. But Ptolomie, Aristotle, and all other old writers affirme the earth to be in the middest, and to remaine vnmoueable, and to be in the very Center of the world, prouing the same with many most strong reasons not needfull here to be rehearsed, because I think fewe or non do doubt therof, and specially the holy Scripture affirming the foundatiõs of yearth to be laid so sure, that it neuer should moue at any time: Againe you shal find in the selfe same Psalme these words, He appointed the Moone for certaine seasons, and the Sun knoweth his going downe, whereby it appeareth that the Sun moueth and not the earth. But leauing this matter, we will now speake of the compasse of the earth, and of the Longitude and Latitude thereof.

Of the compasse of the earth, and of the diuersitie of measures according to diuers countries.

Chap. 6.

CAn the whole earth be measured? Yea very well. for sith the earth and the water (as hath beene said before) doe make together, one whole Spherical or round bodie, and that euery great Cirrle as well thereof as of the heauens, containeth 360. degrees, there is no more then to be done, but to allow for euery such degree 60. Italian miles, which differ not much from our English miles, so as in multiplying 360. degrees by 60. you shall finde the whole compasse of the earth to be 21600. miles: of which compasse if you would knowe the true Diameter, then hauing multiplyed the

the said compasse or circuit of 21600. miles by seuen, diuide the product thereof by 22. and the quotient together with the remainder, will shew the true Diameter which is 6872. miles, fiue furlongs, and $\frac{5}{11}$ of a furlong, and the halfe of that is the semi-Diameter of the earth which is 3436. miles, and $\frac{4}{11}$ of a mile: and as the Italians and we English men doe measure great distances on the earth by miles, so the French, the Spanish, and the high Almaines, doe measure such distances by leagues both by land and sea, and euery one differeth from other: for the French league containeth two of our miles, the Spanish league three, & the common league of Germany foure, and the great league of Germanie containeth fiue of our miles, yea in some places of Germanie, as in Suevia, the leagues are so long as a man shall skant ride three of them in a whole day. Againe the Grecians did measure the distances of the earth by furlongs, the Egyptians by signes, and the Persians by parasanges, all which measures doe greatly differ euen in the smallest parts, from whence all measures doe take their first originall: for as well amongst the auncient men, as amongst them of latter dayes, foure barley kernels couched close together side by side, and not end long, are saide to make a finger breadth, and three finger breadthes an inch, and foure finger breadthes a palme or hand breadth, and three palmes or nine inches a span, and foure palmes or hand breadthes a foote, and two foote and a halfe to make a common pace, and fiue foote to make a Geometricall pace, of which kinde of paces, 125. doe make a furlong, and eight furlongs doe make an Italian mile, and foure such miles do make a common Germaine league, as hath beene saide before, but by reason that the barley kernels be not in all Countries of like bignesse, neither finger breadthes, inches, hand-breadthes, feete, nor any of the other measures are founde any where to bee equall: for the French foote of Paris is longer then ours by an inch, and the Italian foote is longer by two inches and more, and yet their miles are somewhat shorter then ours: and the Germaine foote (according to Stophlerus) is lesse then ours, by two inches and a halfe. But to shew the diuersitie of measures would require a long discourse more intricable then profitable, and therefore I leaue to talke any further thereof, wishing you when we speake of miles, furlongs, paces, or feete, to consider the measure thereof

according

according to the inch or foote of our English standard.

Of the Longitude and Latitude of the earth.

Chap. 7.

WHat meane you by the Longitude and Latitude of the earth?

Longitude is as much to say as length, and Latitude signifieth breadth, for sith the earth is a body, it must needes haue both length, breadth, and depth.

How define you such Longitude and Latitude, and how is it to be counted?

The Longitude of the earth in generall is that space or vpper face of the earth which extendeth from West to East, and againe from East to West: And the Latitude in generall is that space which extendeth North and South euen from the one Pole to the other. Now to know how such Longitude and Latitude is to be accounted, you must first vnderstand that the Equinoctiall Circle girding the earth in the very midst, is deuided into 360. degrees by reason of certaine Meridians which passing through the Poles of the world do cut ech halfe of the Equinoctiall in eighteene points, which being doubled doe make 36. spaces, euery space containing tenne degrees: and some do deuide the Equinoctiall with 36. Meridians, cutting ech halfe thereof into 36. points, which being doubled doe make 72. spaces, euery space containing 5. degrees, which commeth all to one reckoning, for fiue times 72. doe make 360. as well as tenne times 36. of which Meridians, be there neuer so fewe or many (for you may if you will make halfe as many Meridians as there be degrees in the Equinoctiall which amounteth to 180.) yet according to Ptolomie, that Meridian is said to be first and furthest Westward which passeth through the Ilands called Insulæ fortunatæ, for the West Indies were not knowne nor discouered in his daies, nor yet long time after, since the discouerie whereof, the late Cosmographers of these daies doe make the first Meridian to passe through the Ilandes called Azores, which Ilandes, as appeareth by their

Cardes

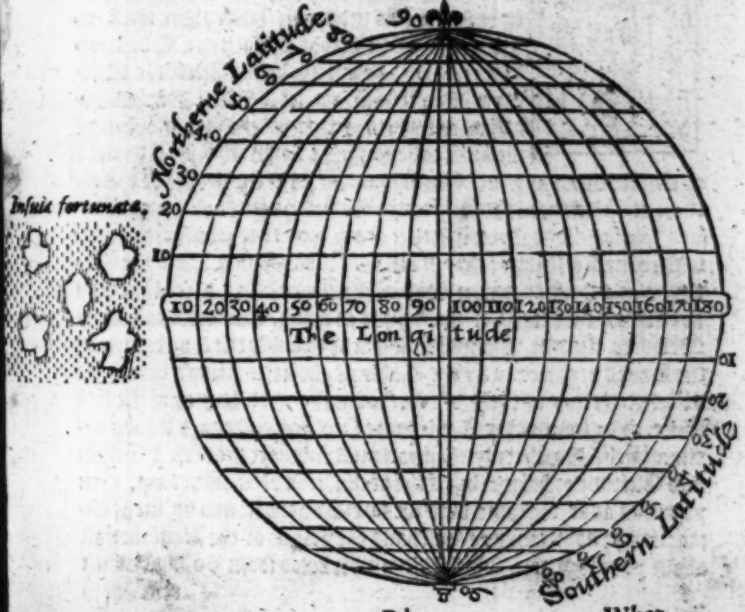
Cardes are situated more Westward from the foresaid Insulæ fortunatæ, by fiue degrees, the reason that moueth them so to do, is because the Mariners Compasse as they say will neuer encline to the true North Pole, but when they sayle either by the Ile S. Marie or S. Michaell affirming that in euery other place the Compasse doth vary from the true [illegible] either by Northeasting or Northwesting. And by thus altering the auncient placing of the first Meridian, they must likewise alter all the Longitudes set downe heretofore by Ptolomie or any other auncient writer, notwithstanding the matter is easie solued, for by adding to euerie Longitude Eastward fiue degrees, or by subtracting fiue degrees from euery Longitude Westward, you shall not greatly varie from those auncient Longitudes that be truely set downe. But to returne againe to my first purpose, I say that whersoeuer this first Meridian cutteth the Equinoctiall, there beginneth the first degree of Longitude, which proceedeth Eastward vntill you come to 180. degrees, which being the one halfe of the earth, is as farre as you can goe Eastward, for then the earth being round, you must needes turne againe Westward vntill you come to the 360. degrees, which is the last degree of Longitude, and endeth where the first degree beginneth: & therefore the Cosmographers measuring alwaies the Longitude by the degrees of the Equinoctiall, doe define Longitude to be that portion of the Equinoctiall Circle, which is contained betwixt the first Meridian and the Meridian of any place supposed, but the distance betwixt any two supposed Meridians (neither of them being the first Meridian,) is not called of them Longitude, but the difference of Longitude: For suppose the distance of the one Meridian, to be twentie degrees distant from the first Meridian, and the other but ten, these Longitudes you see are not like but doe differ, and therefore the distance betwixt any such two places may be very well called the difference of Longitude, and not Longitude it selfe, which hath alwaies regard to the first Meridian and to none other.

Define once againe what Latitude is?

Latitude is none other thing but the distance of any place from the Equinoctiall either towards the North Pole or towards the South Pole, so as there be two kinds of Latitudes, the one Nor-

therne, and the other Southerne: And such Latitude is measured vpon the Meridian which passeth through many places supposed. For euery Meridian is also deuided into 360. degrées, and by reason that the Equinoctiall circleth all such Meridians in the very midst, it deuideth them all into foure equall quarters, euery quarter containing 90. degrées, which is the greatest Latitude that any place can haue, as you may see in this figure following, whereof the first Meridian on the left hand is put to signifie according to Ptolomie, that which passeth through the Fortunate Ilands, or by the Azores according to the moderne Cosmographers (if you will haue it so) containing the degrées of the Latitude both Northward and Southward, and through the midst of all the Meridians passeth the Equinoctiall containing the degrées of the Longitude.

The figure of the Longitude and Latitude of the world.



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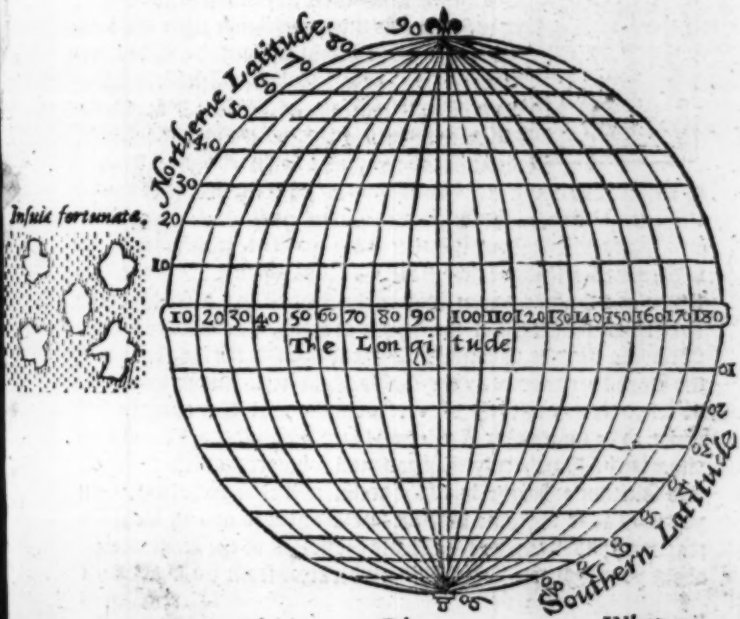
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The figure of the Longitude and Latitude of the world.



What be the other manifold Circles in this figure deuiding the Meridians on ech ſide of the Equinoctiall, as well towards the North Pole, as towards the South Pole.

They are called Parallels, whereof we ſhall ſpeake in the 17. Chapter, in the meane time marke well this figure, that thereby you may the better conceiue what is the Longitude and Latitude of the earth.

Vnderſtanding now the Longitude and Latitude of the whole earth, I am deſirous to know how the Longitude & Latitude of euery ſeueral place of the earth or ſea is to be found out, and how farre any place is diſtant one from another.

How to know the Latitude of any place, as well in the day as in the night.

Chap. 8.

BEcauſe the Latitude of any place is more eaſie to be found (as moſt men thinke) then the Longitude, I will firſt treat of Latitude. The Latitude then is to be known by the Aſtrolabe, Quadrant, Croſſeſtaffe, and by ſuch like Mathematicall inſtruments, & that diuers waies, whereof the moſt eaſie is thus: firſt with your Aſtrolabe or Quadrant, or any ſuch like inſtrument, take the height of ỹ Sun right at noone, when the ſunne is in the firſt point of Aries or of Libra, which height if you ſubtract from 90. that which remaineth is the true Latitude of that place. But if you would know the Latitude at any other day or time of the yeare, then after that you haue taken the height of the Sunne at noone, otherwiſe called the Meridian altitude, you muſt firſt learne to know the true degree of the ſunnes declination by the Table of the declinations before ſet downe, together with the vſe thereof in the 13. Chapter of the firſt booke, or by ſome other Table more lately calculated, & if ſuch declination be Northernly, then you muſt ſubtract that frō the foreſaid Altitude or height: but if the declination be Southernly, then you muſt adde the ſame vnto the foreſaid height, and by ſuch ſubtraction or addition, you ſhall haue the height of the Equinoctiall about your Horizon, which being ſubtracted from 90. that which remaineth

remaineth is the true Latitude of that place: and to be sure in taking the Meridian altitude, it shall bee needefull to take it diuerse times one after another, with some little pawse betwixt, to see whether it increaseth or decreaseth, for if it doth increase, then it is not yet ful noone, but if it decreaseth thē it is past noone. This last way of finding out the latitude, is, & hath beene most commonly taught, as well by the auncient, as moderne writers, as a most sure and ready way of finding the Latitude of any place.

What if the Sun doe not shine at noone, nor perhaps all that day?

Then you must tarrie vntill night that some starre appeare, which you perfectly knowe, and such a one as both riseth and setteth. And hauing taken the Meridian altitude of that Starre with your Astrolabe or Quadrant, you must learne what declination bee hath, and whether it bee Northerne or Southerne. For if the Starre hath North declination, then you must subtract his declination from his Meridian altitude, and the remainder shall bee the Altitude of the Equinoctiall, which being taken out of ninetie, shall bee the Latitude of the place, or eleuation of the pole: but if the declination of the starre bee Southernely, then you must adde his declination to his Meridian Altitude, and that Summe shall bee the Altitude of the Equinoctiall, which being taken out of 90, the remainder shal bee the eleuation of the Pole. As for example, supposing that you knowe the Starre called Arcturus or Bubulcus, and that you finde his Meridian altitude by your Astrolabe or Quadrāt to be 59. degrees 30. minutes, and also that you haue learned by some Table, that his declination to the Northwarde is 21. degrees, 30. minutes: herby taking his saide declination because it is Northernely, out of his Meridian altitude, you finde the remainder to bee 38. degrees, which is the Altitude of the Equinoctiall, which beeing taken from 90, the remainder will bee 52. degrees, which is the Latitude of that place whereas you made your obseruatiō and this is a farre more readie way, then to waite all night to take the Meridian altitude, and also the peyrellion of such a Starre as neuer setteth, which is seldome done in one selfe night. And therefore I would wishe all Mariners to acquaint themselues with many Starres that doe both rise and set, and so shall they

be sure to finde one such starre or other, to bee at his Meridian altitude at any houre of the night that they desire, if the starres doe shew.

How to know the Longitude of any place.

Chap. 9.

THough the Longitude may bee found out by diuers waies not easie for euery mans capacity, yet because Gemma Frisius thinketh none so sure as to know the same by the Eclipse of the Moone, (which also as hee sayeth) may sometime faile by reason of the diuersitie of aspects and Latitude of the Moone, and for that cause hath inuented a more ready way to finde out at all times the Longitude of any place, I minde here therefore briefely to shew you first the order of finding out the Longitude by the Eclipse of the Moone, and then how to find out the same by that readie way which hee hath inuented: the order then to knowe it by the Eclipse of the Moone is thus: First you must learne by some Ephemerides at what houre the Eclipse shall bee in some place, where you know alreadie by some Table the Longitude, that done, you your selfe or some other for you must the same day of the Eclipse obserue by the Astrolabe at what houre the eclipse beginneth in that place, where of you know not the Longitude: For if the Eclipse doe beginne in both places at one selfe houre, then assure your selfe that both places haue one selfe Longitude, but if it beginne sooner or later, then there is difference betwixt them, according to the varietie of the time, which difference is thus to bee knowne. take the lesser summe of houres out of the greater, and there shall remaine eyther houres, or minutes, or both, if houres, then multiply the same by fifteene, if minutes, deuide the same by foure (for in this account fifteene degrees doe make one houre, and foure minutes doe make one degree) and adde the difference so found to the Longitude, if the Eclipse doe appeare there sooner if later then subtract the said difference from the knowne Longitude, and that which remaineth will shew the vnknowne longitude. But note by the way, that if there remaine a-

ny

ny minutes after the diuiſion, you muſt multiply thoſe minutes by 15. and ſo ſhall you haue the minutes of degrées.

Shew the vſe of this rule by ſome example.

For example I finde by the Tables of Ptolomie, that the Longitude of Paris in Fraunce is 23. degrées, and by ſome Almanacke or Ephemerides I find that the Eclipſe doth begin there at three houres after midnight, now by this I would know the Longitude of Tubing a famous Cittie in Sueuia, which is a region of Germanie, at which towne in the very day of the Eclipſe I cauſe to be obſerued by Aſtrolabe at what houre the Eclipſe beginneth there, and I finde that it beginneth at 3. of the clocke and 24′. after midnight, then by ſubtracting the leſſer number of time out of the greater, I finde the remainder to be 24′. which being deuided by 4′. which doe make one degrée, the quotient ſhall be 6. degrées, and that is the difference, which being added to the knowne Longitude of Paris (becauſe the Eclipſe is ſooner there than at Tubing) it maketh in all 9. degrées, whereby I gather that the Longitude of Tubing is 29. degrées, by this meanes all the Tables of Coſmographers are moſt commonly made, and yet many times they greatly differ in their Longitude for lacke perhaps of vſing diligence in taking the right houre and moment of the Eclipſe, and for not duely conſidering the diuers aſpects, and what Latitude the Moone hath at that inſtance which may cauſe great error.

A readie way to finde out the Longitude of any place, inuented by Gemma Friſius.

Cap. 10.

THat way is done by the helpe of ſome true Horologie or watch apt to be carried in iourneying, which by an Aſtrolabe is to be rectified and ſet iuſt at ſuch houre as you depart from the place where you are, to goe to any other place whereof you are deſirous to know the Longitude, in which your going you muſt be diligent to ſee that

your watch neuer cease going, and being arriued at that place whereof you seeke to know the longitude, you must tary vntill the Inder do iustly touch the prycke of some perfect houre, and also at that instant, to see what houre it is by your Astrolabe, for if your Astrolabe and watch doe both agree in one, then assure your selfe that there is no difference of longitude, but that you haue trauelled still vnder one selfe Meridian either towards the North or South. But if they differ one houre or certaine minutes, then reduce them to degrees, or to the minutes of degrees in such order as is before taught, and thereby you shall find the longitude which you desire to know. But to take the longitude of any place vpon the sea by this manner of way, most men thinke it were a great deale better to do it by the help of a great houre glasse, made to run 24. houres, which must be watched when it is ready to run out, that it may be immediately turned: for watches made of Iron or Steele wil soone rust vpon the sea. This way of taking the Longitude and many others, I doubt not but that M. Borrough hath tried, and thereby is able to iudge which is best, wherefore in mine opinion he may doe his countrie great good by setting downe in writing that way which he by experience knoweth to be best and readiest, for want whereof the Mariners cardes doe make the sea men oft to erre in their voiages.

Another way taught by Appian to find out the longitude of any place with the crosse staffe by knowing the distance betwixt the Moone and some knowne star that is situated nigh vnto the Ecliptique line.

Chap. 11.

FIrst seeke to know by the Astronomicall tables the true moouing of the Moone according to the longitude at ỹt time of your obseruation at some certaine place, for whose Meridian the Rootes of those Tables are calculated & verefied. Also you must know the degrée of longitude of some fixed starre nigh vnto the Ecliptique going either next before

before or else next after the mooning of the Moone, then you must seeke out the distance of the mooning of the Moone and of the said starre, which distance once had, apply the crosse staffe to your eye, and moue the crosse vp and downe vntill you may see the center of the body of the Moone with the one end of the crosse and the foresaide fixed starre with the other ende of the crosse, so shall the crosse shew you by the degrees and minutes marked vpon the staffe, the distance of the Moone and of the foresaide star answerable to the place of your obseruation, which being set downe, set downe also the distance betwixt the Moone and the foresaid star that was first calculated, & then take the lesser out of the greater, so shal remaine the last difference, which may bee rightly called the diuersity of aspects, which difference if you diuide by the mooning which the Moone maketh in one houre, you shall knowe thereby the time in which the Moone is or was ioyned with the first distance of the foresaide starre, then hauing conuerted that time into degrees and minutes, adde or subtract the product thereof to or from that Meridian, vnto which the Tables (whereby you first calculated the mooning of the Moone) were verified, that is to say, if the distance betwixt the Moone and ỹ fixed starre of your obseruation be lesser, then adde the degrees and minutes to the knowne Longitude, so shall you find the place of your obseruation to be more Eastward, but if it be greater, then subtract the degrees and minutes from the knowne Longitude, and the place of your obseruation shall bee more Westward. All which rules Gemma Frisius affirmeth to be true, so as the Moone be more Westward than the fixed starre: for if at the time of your obseruation the Moone bee more Eastward, then you must worke cleane contrarie, that is to say, if the distance betwixt the Moone and the fixed starre be lesser, you must subtract the degrees and minutes from the knowne Longitude, so shall the place of your obseruation be more Westward: but if it be greater, then you must adde the degrees and minutes vnto the knowne Longitude, and you shall finde the place of your obseruation to be more Eastward.

How to know the diſtance of places, that is to ſay, how many miles one place is diſtant from another, and howe many waies places are ſaid to differ in diſtance one from another.

Chap. 12.

THe diſtance may bee knowne diuers waies, that is either Arithmetically, Geometrically, or by the Tables of Sines. But before I ſhew you the order of any of theſe waies, you haue to vnderſtand that any two places doe differ in diſtance one from another one of theſe 3. maner of waies, that is, either in latitude onely, or in longitude onely, or els in both if two places hauing one ſelfe longitude do differ onely in latitude: then according to the Arithmeticall way you muſt ſubtract the leſſer latitude out of the greater, and the remainder ſhall be the difference, which being multiplyed by 60. will ſhew ỹ number of miles: as for example, London and Roan, hauing in a maner one ſelfe longitude, doe differ onely in latitude, for the latitude of London is 51. degrees 32. and the latitude of Roan is 49. degrees and 10′ which being the leſſer latitude and therefore to be taken out of 51 degrees 32′. there remaineth 2. degrees 22′. which 2. degrees being multiplied by 60. maketh 120. whereunto if for the 22′. annexed to the degrees you adde 22. miles (for euery minute is a mile) it ſhall make in all 142. miles, which by a right line is the true diſtance betwixt London and Roan. But you haue to note that the difference of 2. ſundrie latitudes is not to bee knowne by ſubtracting the leſſer out of the greater, vnleſſe both the places be ſo ſituated, as both may haue either North latitude or South latitude, for if the one place haue North Latitude and the other South latitude, the difference is to bee knowne by addition, and not by ſubtraction: As for example, Naples in Italy hath 41. degrees of North latitude, and la Madelena in Aphricke not far from Manicongo, hath 8. degrees of South latitude, both places hauing one ſelfe Meridian, here the difference of theſe two latitudes is to be knowne by addition, and not by ſubtracting the leſſer out of the greater, for 8. and 41. being added together do make 40. and that is ỹ true difference, which being multiplied by 60. maketh 2940.

miles

miles. So likewise the difference of the two longitudes is not alwaies knowne by subtracting the lesser out of the greater, vnlesse þ two places haue both East longitude, or else both West longitude: As for exãple Lisbona in Spaine hath in East longitude 13. degrees and Cap de los flauos in the West Indies hath in West longitude 334. degrees: here the difference of these two longitudes is not to be known by taking the lesser out of the greater, but thus, first take 334. out of 360. & there wil remaine 26. degrées, whereunto if you ad þ East longitude for Lisbona, which is 13 degrées, it will make in all 39. degrees, which is the true difference of the 2. longitudes, for if you should take 13. degrees out of 334. there would be remame 321. which is not the true difference. But to know the distance of two places differing in longitude, this Table here following is needfull.

The Table of miles aunswerable to one degree of euery seuerall latitude.

1			2			3			4			5			6		
D	M	S	D	M	S	D	M	S	D	M	S	D	M	S	D	M	S
1	59	59	16	57	41	31	51	26	46	41	41	61	29	5	76	14	31
2	59	58	17	57	23	32	50	53	47	40	55	62	28	10	77	13	30
3	59	53	18	57	4	33	50	19	48	40	9	63	27	14	78	12	28
4	59	51	19	56	44	34	49	45	49	39	22	64	26	18	79	11	27
5	59	46	20	56	23	35	49	9	50	38	34	65	25	21	80	10	25
6	59	40	21	56	1	36	48	32	51	37	46	66	24	24	81	9	23
7	59	33	22	55	38	37	47	55	52	36	56	67	23	27	82	8	21
8	59	25	23	55	14	38	47	17	53	36	7	68	22	29	83	7	19
9	59	16	24	54	49	39	46	38	54	35	16	69	21	30	84	6	16
10	59	5	25	54	23	40	45	58	55	34	25	70	20	31	85	5	14
11	58	54	26	53	56	41	45	17	56	33	33	71	19	32	86	4	11
12	58	41	27	53	28	42	44	35	57	32	41	72	18	32	87	3	8
13	58	28	28	52	59	43	43	53	58	31	48	73	17	33	88	2	5
14	58	13	29	52	29	44	43	10	59	30	54	74	16	32	89	1	3
15	57	57	30	51	58	45	42	26	60	30	0	75	15	32	90	0	0

De-

Describe this Table.

This Table is deuided into 6. collums, euery collum containing, first the degrees of latitude, and then the miles and seconds of miles aunswerable to euery degrée, for euery degrée of the very Equinoctiall it selfe is in value 60. miles, but the further you goe from the Equinoctiall either Northward or Southward, euerie degrée of latitude is lesser in value than other, and containeth fewer miles, as you may easily sée by the said Table, proceeding from one degrée to 90. which is the greatest latitude that any place can haue.

How to knowe by the helpe of the foresaid Table the distance of two places differing only in longitude.

Chap. 13.

YOu must multiplye the difference of the longitudes by the number of miles aunswerable to the latitudes of the said places, omitting alwaies the seconds of miles set downe in the saide Table, because in this account they are of smal importance: as for example, London and Antwarpe, hauing both in a manner one selfe latitude, doe differ onely in Longitude 6. degrees 42′. which difference being multiplyed by 37. miles answereable to 51 degrees of latitude, as you sée in the Table, doe make in all 247. miles and 54″. of a mile. But in making this multiplication, you must first multiply the 6. whole degrees by 37. and the product thereof will amount to 222. then by the rule of proportion you may finde out the value of the minutes annexed to the degrées of the difference of Longitude in saying thus, if 60′. which is one degree, doe require 37. miles, what shall 42′. require. And by working according to the rule of proportion, you shall finde the fourth number which you seeke to bee 25. miles and 54″. which being added to the first product 222, maketh in all 247. miles and 54″. of a mile, which wanteth but 6″. to make vp another mile.

How

How to finde out the true diſtance of two places differing both in longitude and latitude by the Arithmeticall way.

Cap. 14.

HOw is that done?

Firſt, take the difference of the Longitudes and Latitudes of both places by ſubtracting the leſſer out of the greater, then conuert the ſame into miles by multiplying the difference of the two Longitudes into the miles that be anſwerable to the Latitude of each place, which miles you ſhall finde in the Table aforeſaid, and if there be any minutes annexed to the degrées of the difference of Longitude, then reduce the ſame alſo to miles by the rule of proportion, as before is taught, and hauing added the two products together, halfe the ſumme, and ſet it by it ſelfe. Then multiplie the difference of the Latitudes into 60. miles, and adde thereunto the Fraction of minutes annexed to the ſaid difference if it hath any fraction, following for euery minute one mile, and ſet that number alſo by it ſelfe: that done, ſquare the ſummes reſerued, that is to ſay, multiply eche one part by it ſelfe into it ſelfe, and hauing added the two products together into one Summe, ſeeke out the ſquare roote thereof, and that ſhall be the true diſtance of the two places. As for example, if you would know the true diſtance betwixt London and Venice, firſt you muſt know by ſome Table the Longitude and latitude of both townes, wherefore finding the Longitude of London to be 19. degrées, 54′. and the latitude thereof to be 51. degrées, 32′. And the longitude of Venice to be 35. degrées, 30′. and the Latitude thereof to be 44. degrees, 45′. Now by ſubtracting the leſſer Longitude out of the greater, I find the difference of Longitude to be 15. degrées, 36′. and by ſubtracting the leſſer latitude out of the greater, I finde the difference of latitude to be 6. degrées, 47′. Then knowing the latitude of London to be 51. degrees, I reſort to the Table of miles appointed for euery degree of latitude before ſet downe, and there I find that to 51. degrées of latitude doe anſwere 37. miles and certaine

taine seconds, which being of small moment are not woont to be reckoned. Then in multiplying the difference of the Longitudes which is 15. degrées 36′. by 37. miles, I finde the product of the 15. degrées so multiplyed to be 555. and because there be 36′. annexed to the foresaid 15. degrées, I seeke by the rule of proportion to know how many miles that fraction containeth, in saying thus, if 60. require 37. what shal 36. require? & I find 22. miles, which being added 555. maketh 577. then by seeking in the foresaid Table how many miles be answerable to the Latitude of Venice, which is 44. degrées, I finde the number of miles to be 43. by which number I multiply once again the difference of longitude, which is 15. degrees, 36′. the product whereof, together with the fraction annexed thereunto being converted into miles by the rule of proportion, as before, doth amount to 670. which summe being added to the former converted longitude, which is 577. maketh in all 1247. the halfe whereof is 623. which halfe number I reserue by it selfe, that done I multiply the difference of the latitude, which is 6. degrees 47′. by 60. miles, in saying 6. times 60. maketh 360. whereunto I adde for the 47′. annexed 47. miles, and it maketh in all 407. which summe I reserue also by it selfe. Then I multiplie the first reserued number into it selfe, the product whereof is 388. 129. That done, I multiply the second reserued number also into it selfe, the product whereof is 165649. which two last productes being added together, do make in all 553778. whereof the square roote being taken, is 744. miles, which is the true distance of Venice by a right line from London. And to the intent that the order and working herein may more plainely appeare vnto you, I haue set downe all the particular numbers of the same here by themselues, as it were in a Table.

	Longitude.	Latitude.
London.	19. degr. 54′.	51. degr. 32′.
Venice.	35. degr. 30′.	44. degr. 45′.
The difference of their longitudes and Latitudes.	15. degr. 36′.	6. degr. 47′.

The

The difference of the longitudes conuerted into miles: for London is	577
For venice.	670
The summe of the two conuerted longitudes added together, is	1247
The halfe whereof, which is the first reserued number, is	623
the second reserued number, which is the difference of the latitudes, conuerted into miles, is	407
The summe of the first reserued number multiplyed into it selfe, is	388129
The summe of the second reserued number multiplied into it selfe, is	165649
The summe of both added together, is	553778
The square roote whereof, which is the summe of the miles, is	744

How to find out the distance betwixt two places, differing both in longitude and latitude by helpe onely of a demicircle deuided into 180. degrees without any Arithmeticke.

Cap. 14.

BVt now because the way before taught to finde out such distance by the Arithmetical way may seeme perhaps to some folkes verie busie and tedious, I haue thought good therfore to set downe this other way which was sent me not long since frō my louing friend Master Wright of Caius Colledge in Cambridge who is well learned in the Mathematicals, and is so apt therunto by nature, as hee is like inough to atteine to such perfit knowledge therein

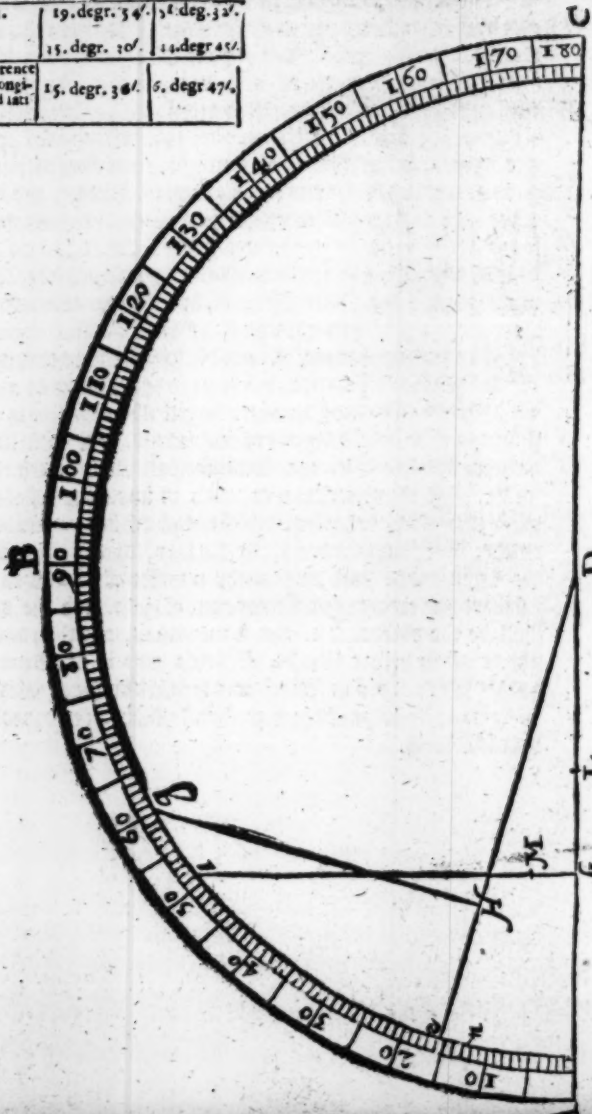
knowledge therein as he may be able thereby hereafter greatly to profite his country, if for want of sufficient exhibition he be not forced to leaue so noble a studie, wherefore I wish with all my heart that all Gentle men of abilitie were minded to shew their liberality towards him in that behalfe. But to returne to my matter, I say that the way to find out the foresaid distance is this here following: first, hauing drawne a demicircle vpon a right Diameter (the larger that the demicircle is, the better) and diuide the same into 180. degrees, like vnto this hereafter described, and marked with the letters a b c d. whereof d. is the center and a.c. the Diameter. Then learne first by some Table to know the longitude and latitude of both places, and the difference of their longitudes, as you did before in seeking to know by the Arithmeticall way the distance betwixt London and Venice, the difference of whose two longitudes is 15. degrees, and 36′. as you may see in the former Table for in working by this way, you haue chiefly to seeke out in the circumference of ỹ demicircle but three things, that is, first, the difference of the two longitudes, secondly, the lesser latitude, and last of all the greatest latitude. Knowing therefore the difference of the said two places in longitude to be 15. degrees, 36′. seeke out ỹ same in the demecircle, beginning to count at A. & so proceede towards B. And at the end of those degrees and minutes set downe a pricke marked with the letter e. vnto which pricke drawe a right line by your ruler from D. the center of the demicircle. That done, seeke out the lesser latitude, which is 44. degrees, and 45′ in the foresaid demicircle, beginning to account the same from the pricke e, and so proceede towards the letter B. and at the end of the said lesser latitude, set downe another pricke marked with the letter g. from which pricke or point draw a perpendicular line, which by helpe of your squire or compasses may fall with right angles vpon the former right line drawne from D. to e. and where it falleth, there set downe a pricke marked with the letter h. That done seeke out the greater latitude which is 51. degrees, & 32′. in the foresaid demicircle, beginning to account the same from A. towards B, and at the end of that latitude set downe another pricke marked with the letter I. from whence draw another perpendicular line, that may fall by helpe of your squire or compasse with right angles vpon the Diameter A.C. and there make a pricke marked with the letter K.

That

That done, take with your compasse the distance that is betwixt k. and h. which distance you must set downe vpon your said Diameter A.C. setting the one foote of your Compasse vpon k. and the other towards the center D, & there make a pricke marked with the letter L. Then take with your compasse the length of the shorter perpendicular line g.h. and apply that wideneſſe vpon the longer perpendicular line I. K. setting the one foote of your Compasse at I. which is the end of the greater Latitude, and extend the other foote towards K. and there make a pricke marked with the letter M. That done, take the distance betwixt L. and M. with your Compasse, and apply the same to the demicircle, setting the one foote of your Compasse in A. and the other towardes B. and there make a pricke marked with the letter N. And the number of degrées contained betwixt A. and N. will shew the true distance of the two places, which you shall finde to be 12. degrées and almost 24'. Now by allowing for euery degrée 60. miles, and for euery minute a mile, the Summe of miles will agree with the former distance found out by the Arithmeticall way, which was 744. miles. And thus you haue to deale to know the distance of any other two places whatsoeuer, differing both in Longitude and Latitude. But you haue to note by the way, that if the difference of the Longitudes both exceede the number of 180. then you must subtract that exceeding difference out of 360. and the remainder shall be the difference of the Longitudes, and then worke in all points as is before taught. And this way is as Geometricall, as that which Appian setteth downe in his booke of Geographie, to be done by helpe of the terrestriall Globe, the order whereof here followeth.

How

	Longitude.	Latitude.
London.	19. degr. 34′.	51. deg. 32′.
Venice.	15. degr. 20′.	44. degr 45′.
The difference of their longitudes and latitudes is	15. degr. 36′.	6. degr 47′.



How to find out the distance of the places by the Geometricall way.

Cap. 15.

HOw is that done?

Most readily and easily by helpe of a terrestriall globe in this maner following. First take the distance of the two places by extending your compasse vpon the Globe, from the one place to the other, which if you would know how many miles it comprehendeth, apply the same distance so taken vnto the Equinoctiall line, setting the first foote of your Compasse vpon the first Meridian in that point, whereas it cutteth the Equinoctiall, then see how many degrées of the Equinoctiall are comprehended betwixt the two féete of your Compasse, and multiply those degrées by 60. and the product thereof shall shew you how many Italian miles such distance is in length. But if either of the places or both, be wanting and not expressed in the Globe, then you must learne by the Tables of Ptolomey or of some others, as of Appian, Gemma Frisius, Orontius or such like, the longitude and latitude of the said places, that done, hauing sought out the Longitude of the first place in the Equinoctiall, turne the globe about with your hand vntill you haue brought the Longitude right vnder the brazen Meridian, which being stayed there, séeke out in the said Meridian the Latitude of the said place, and there set a marke vpon the globe, for there the place should stand, and doe in like manner to finde out the second place: Then by extending your Compasse from the one marke to the other, you shall haue the true distance, which distance if you apply to the Equinoctiall like as before is taught, the degrées thereof being multiplyed by 60. will shew you how many myles those two places are distant one from another.

May not the distance of places be found out as well by an vniuersall Map as by the globe terrestriall?

Yes indéede and more readily by reason that for the most part euery Map hath his proper scale, so as you néed to do no more but to take the distance of the 2. places with your Compasse, and to

apply the same to the scale shewing the miles or leagues.

What if the Map haue no skale?

Then you must take out the distance by such meanes as I doe shew in my Treatise of the vse of vniuersall Mappes, and also in my description of Plancius his Map.

I pray you in the meane time proceede in shewing me the third way of finding out of the distance of places which you said was *per tabulas Sinuum*?

The order of finding out the distance of 2. places differing both in longitude & latitude per tabulas Sinuum, is plainly set downe before in the end of my Arithmeticke, whereas I do make a plain description of the said Tables, & do shew the vse thereof as well by this as by diuers other examples, wherefore I wish you to resort to that treatise and you shall haue your desire. For hauing for this time sufficiently spoken of the Longitude, Latitude and distance of places, and how the same is to be found out, I thinke it mete to treate of the 5. Zones, of Climes and Parallels, whereinto the ancient Cosmographers thought good to deuide the earth, to the intent that euery part thereof might be the better knowne how it is situated either Northward or Southward, whether it be hot or cold, or betwixt both, and of what length the day and night is in euery place, & what manner of shaddow the Sunne yeldeth euerie where, and such like accidents, and first of the 5. Zones.

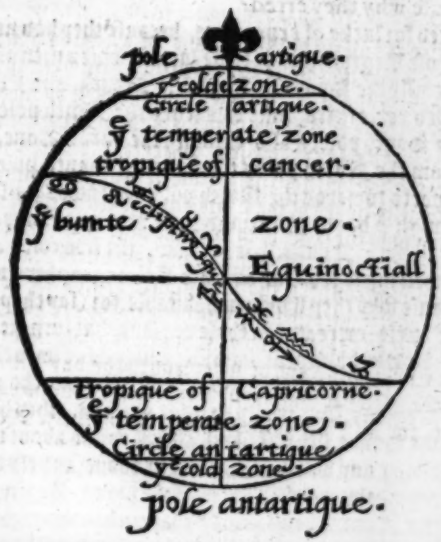
Of the 5. Zones.

Cap. 16.

THe most ancient Cosmographers considering how the Sun by his oblique, and variable course did warme with his beames one part of the earth more then another, gathered thereby that the earth had three temperatures that is to say, extreame hot, extreame cold, and a meane temperature, that is, neither too hotte, nor too colde: And therefore to shew vs vnto which of these temperatures, any part of the earth was subiect, they deuided the earth into 5. Zones,

answera-

answerable to the 5. Zones of the firmament, by helpe of the Equinoctiall and the 4. lesser Circles before described in the first part of this treatise, the 20. Chapter, and are there set foorth in figure, which figure I thought good to set downe againe in this place to the intent you might the better remember what was saide there touching the Zones.



But other Cosmographers comming afterward, not satisfied with the 5. Zones, because they shewe nothing but the situation and the three temperatures of the earth, did deuide the earth into certaine Climes and Parallels, to finde out thereby the length of the day and night in euery place, and the true latitude thereof as Ptolomey and many others after him haue done, making such diuisions as we shall speake of hereafter. But truely I thinke with Mercator, that the best and most exact way of deuiding the earth to serue all purposes is to be made by degrees and minutes, wherin is lesse error then in Climes & Parallels, neither can Climes or Paralels be so well described when you draw nigh to any of the Poles, for that the spaces as well betwixt the Parallels as betwixt

the Meridians do grow continually ſtraighter and ſtraighter, as you may ſee in the figure of Paralels hereafter following.

I remember that in the 20. Chapter whereas you deſcribed the 5. Zones, you ſaid that the ancient men did greatly erre in affirming 3. of the Zones to be vnhabitable, that is the two cold Zones and the hote Zone, I pray you therefore ſhew me here the cauſe why they erred?

They erred for lacke of experience, becauſe they had neuer traueled into thoſe Regions, but in theſe latter daies men of diuers nations, ſpecially the Spaniſh, Engliſh, French, and Flemmiſh, haue trauelled verie farre, ſome towardes the North pole, & ſome towards the South pole, & alſo through the burnt Zone, for thoſe that ſayle from the North parts towards the South pole, or from the South parts towards the North pole, muſt nedes paſſe in their voyage through ỹ burnt Zone: and theſe men do affirme that they haue found all the 3. Zones, that is to ſay, the two colde and hotte zones to be well inhabited. And our late Coſmographers do not let to render cauſe why they ſhould be habitable, for (ſay they) though the colde be verie extreame in thoſe regions that lie next vnto the Poles, yet the Sunne appearing and giuing ſhine vnto them both day and night, doth greatly qualifie and moderate the extreame cold of thoſe regions. But truely, in mine opinion, they haue ſmal comfort of the Sunne, ſith it ſtriketh almoſt round about their feete without yeelding any warme reflexe from aboue, and eſpecially to thoſe that doe inhabite nigh to either of the Poles. Againe, they ſay that the burnt Zone is habitable, by reaſon that the night to them is cõtinually as long as the day, the coolenеſſe whereof doth greatly refreſh the extreame heat of the day. But now let vs returne to our purpoſe, and ſpeake ſomewhat of the Climes and Paralels, and becauſe euery Clime conſiſteth of two Paralels, I thinke it beſt to ſpeake firſt of Paralels.

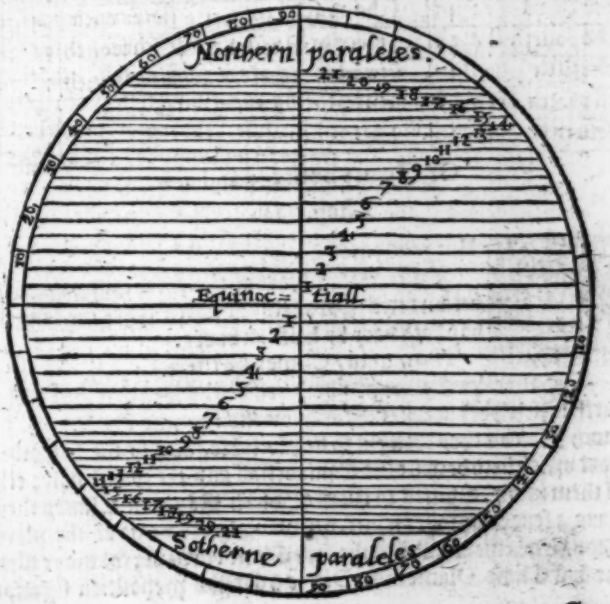
Of Parallels,

Chap. 17.

WHat be Parallels?

Parallels bee lines eyther right or circular alwayes equally diſtant one from another ſo as they can neuer meete. And of Paralels that are to be conſidered in the Spheare,

Spheare, some make 3. kinds, according to their threefold signification, for some are called the Parallels of the sunne, who in departing from the Equinoctiall towards any of the Poles, maketh euery day throughout the yeare one Parallel, so as in going from the Equinoctiall to the Tropique of Cancer, he maketh 182. Parallels. And as many againe in going from the Equinoctiall to the Tropique of Capricorne. The second kind of Parallels are called the Parallels of Latitude. And the third the Parallels of the longest day, which two last are in effect both one, for the further that any Parallel is situated from the Equinoctiall towards either of the Poles, the more Latitude it hath, & so by consequent maketh the day longer to those that dwell vnder that Parallel, of which Parallels the auncient Cosmographers doe make in all but 21. proceeding proportionally either towards the North Pole or South Pole, as you may see by this figure here following, the middle line or Circle whereof is the Equinoctiall.



And euery Parallel proceeding from the said Equinoctiall, either Northward or Southward, doth lengthen the day by one quarter of an houre in such proportion as this table here following sheweth, appointing to the first Parallel, and next vnto the Equinoctiall 4.degr.& 1′5.and to the second parallel 8.degr.3′0. and so forth vntill you come to the 21.Parallel passing through Island,which Parallel is distant from the Equinoctiall 63. degr. 1′6.further then which parallel Northward, the Tables of Ptolomie do not extend, and Southward they extend no further then to that Parallel which hath lesse then 20.degrees of Latitude.

The Table of Parallels shewing how many degrees and minutes euery one is distant from the Equinoctiall,made according to the rule of Ptolomie.

Parallels	D	M	Parallels	D	M	Parallels	D	M
the first	4	15	the eight	30	45	fifteenth	48	40
the second	8	30	the ninth	33	40	sixteenth	51	50
the third	12	45	the tenth	36	24	seuẽtenth	54	30
the fourth	16	35	eleuenth	39	0	eighteenth	56	30
the fifth	20	30	twelfth	41	20	nineteenth	58	20
the sixth	24	15	thirteenth	43	15	twentieth	61	10
seuenth	27	30	fourteenth	45	24	the xxi	63	16

Of Clymes both old and new.

Chap. 18.

WHat is a lyme?

A Clime is a space of the earth comprehended betwixt two Parallels, in which space the longest day doth varp by halfe an houre.

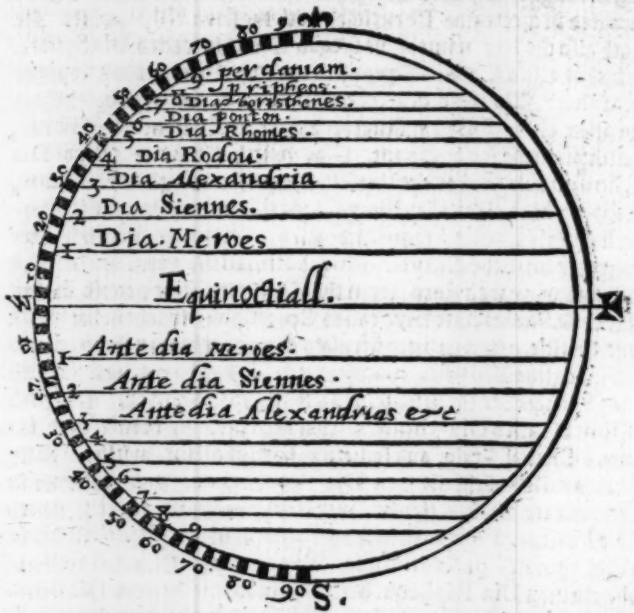
How many Climes be there?

The auncient Cosmographers deuided as well that part of the earth which lyeth betwixt the Equinoctiall and the North pole, so much I say as they thought to be habitable, as also the habitable part which lieth betwixt the Equinoctiall and the South pole, ech of them into 7. Climes,to euery of which Northern Climes they gaue a seuerall proper name, according to the name of the place through which the midst of the said Clime did passe, for they called the first Clime Diameroes, Dia is a Greeke preposition signifying

ing in English, By or Through, and Meroes is a Citty of Egypt situated in a certaine Ile enclosed with the flood Nilus, which Ile hath also the like name. The second Clime is called Dia Sienes, which is also a Citty in Egypt situated right vnder the Tropique of Cancer. The third Clime is called Dia Alexandrias, which is an other Citty of Egypt situated vpon the West mouth of Nilus, falling into the sea of Egypt. The fourth Clime is called Dia Rhodou, Rhodos is the chiefest Citty of an Ile called Rhodos, standing in the sea called Mare Carpathium, washing the South-west end of Natolia, sometime called Asia minor, which Ilande together with the Citty Rhodos, Soliman the great Turke wan not many yeares since from the Christians. The people of this Ile in S. Paules time were called Colossians, to whom hee wrote one Epistle, and they were so called of a great brazen Image called in Latine Colossus, contayning in Altitude 105. feete, which was dedicated to the Sunne, or as some say to Iupiter. The fifth Clime is called Dia Rhomes, that is to say, by Rome that famous Citie of Italy, and sometime head of all the worlde. The sixth is called of the old men Dia Boristhenes, notwithstanding the moderne writers thinke that it may bee more rightly called Dia Pontou, Pontus is both a sea and countrey lying Eastwarde right against Constantinople. The seuenth Clime is called of the old men Dia Ripheos. but of the moderne writers Dia Boristhenes, which is a great flood of Scithia in the South parte of Sarmatia which falleth into the sea called Mare Euxinum. To these seuen Climes Appian addeth two others, so as in all he setteth downe nine Climes, making the eight Clime to passe through Ripheos, which are mountaines enuironing Sarmatia, on the Northside, and the ninth through Denmarke.

What names did they giue to the Southerne Clymes?

The selfe same that the Northerne Clymes haue, sauing that they put before euery such name this Greek word Anti, which is as much to say as Contrary or right against, as Anti Meroes Anti Syenes, &c. as you may easily perceiue by this figure of Clymes here following, notwithstanding none of those Southerne Clymes were knowne to Ptolomie more then Anti-Meroes, and hardly all that, the furthest part whereof hath not twenty degrees of Latitude.



And note that euery such Clime is deuided into 3. parts, that is the beginning, the midst, & the end. And if you would knowe what degrees and minutes of Latitude euery such part hath, that is to say, how many degrees euery such part is distant from the Equinoctiall, then consider well this Table following, which both briefly and plainely sheweth the same.

Degrees & minutes of houres	The beginning. D	M	The midst. D	M	The end. D	M
The first Clime.	12	45	16	35	20	30
The second Clime	20	30	24	15	27	30
The thirde Clime.	27	30	30	45	33	40
The fourth Clime	33	40	36	24	39	0
The fift Clime.	39	0	41	20	43	30
The sixt Clime.	43	30	45	24	47	15
The seuenth Clime	47	15	48	40	50	30
The eight Clime.	50	30	51	50	53	10
The ninth Clime.	53	10	55	20	56	30

May not the North & South part of the world ech of them be deuided into more then 9. Climes?

Yes indæde as our latter writers affirme, for betwixt the Equinoctiall and the 66. degrée and 30. of Latitude, in which the longest day contayneth full 24. houres without hauing any night, they make 48. Parallels, and therby 24. Climes, for euery Clime containeth two Parallels, and euery Parallell maketh the day to encrease by one quarter of an houre as hath béene saide before. But from thence forth, though you may continue the Parallels almost to the very Pole, yet you can make no more but 24 Climes by reason that the spaces of the Parallels towards either of the Poles, doe grow more narrow euery one then other, so as from 66. degrees and 30. minutes of Latitude vnder which the Circle Arctique passeth, the longest day is not to bee counted any more by houres, but by whole daies, wéekes, and monethes, in so much as they which dwell right vnder the North pole, whose Zenith is the pole it selfe, haue sixe monethes day whilst the Sunne abidethin the sixe Northerne signes, and 6. moneths night, the Sun being in the sixe Southerne signes. And contrariwise they that dwell right vnder the South pole haue 6. months day, the Sunne being in the 6. Southerene signes, and 6. months night whilst the Sun remaineth in the 6. Northerne signes. But because I thinke it a more ready way to account the length of the day by the degrées of Latitude, then by Climes or Parallels, I thought good here to set downe Orontius his Table made for that purpose, which from the 67. degrées of Latitude to the North pole agréeth in all pointes with the Table of Iohannes de sacro Busto, in which Table from the saide 67. degrée is not only set downe the longest day, but also what portion of the Zodiaque alwaies appeareth aboue the horizon, which portion when it containeth one whole signe, then the day is one month long, & the night as much, if two signes, then the day is two moneths long and the night as much, and so forth successiuely vntill you come to 6. signes, which is the one halfe of the Zodiaque, making both day and night each of them sixe moneths long, as I haue saide before, and as you may plainely see with your eye by placing the Spheare on his Horizon at euery such Latitude.

A Table shewing the longest day in euery dégree of La-
North Pole, by whole degrees without minutes from one de-

Degrees of latitude.	The longest day.			Degrees of latitude.	The longest day.		
D M	H	M	S	D M	H	M	S
1 0	12	3	28	34 0	14	16	24
2 0	12	6	56	35 0	14	21	52
3 0	12	10	24	36 0	14	27	20
4 0	12	14	0	37 0	14	33	4
5	12	17	28	38	14	37	36
6	12	20	56	39	14	44	56
7	12	24	48	40	14	51	12
8	12	28	0	41	14	57	44
9	12	32	36	42	15	4	24
10	12	35	12	43	15	11	20
11	12	38	48	44	15	18	40
12	12	42	44	45	15	26	8
13	12	46	8	46	15	34	8
14	12	49	44	47	15	42	24
15	12	53	28	48	15	51	4
16	12	57	20	49	16	0	8
17	13	1	4	50	16	9	44
18	13	4	46	51	16	19	52
19	13	8	56	52	16	30	32
20	13	12	48	53	16	41	52
21	13	16	48	54	16	54	8
22	13	21	4	55	17	7	4
23	13	25	4	56	17	21	4
24	13	29	20	57	17	36	16
25	13	33	35	58	17	52	48
26	13	38	0	59	18	10	48
27	13	42	24	60	18	30	56
28	13	46	16	61	18	53	20
29	13	51	36	62	19	18	24
30	13	56	16	63	19	48	40
31	14	1	12	64	20	24	24
32	14	6	8	65	21	10	32
33	14	11	12	66	22	20	

titude, proceeding orderly from the Equinoctiall to the degree to 90.

Degrees of latitude		The longest day			The arch of the Zodiaque alway appearing aboue the Horizon.		
D	M	Daies	H	M		De.	M
67	0	24	1	40		22	52
68	0	42	1	16		40	0
69	0	54	16	25		52	0
70	0	64	13	46		61	26
71		74	0	0		70	26
72		82	6	36		78	22
73		89	4	58		84	56
74		96	17	0		92	12
75		104	1	4		96	20
76		110	7	27		105	16
77		116	14	22		111	20
78		122	17	6		117	6
79		127	9	55		122	46
80		134	4	58		128	22
81		139	31	36		133	50
82		145	6	43		139	6
83		151	2	6		144	22
84		156	3	3		149	36
85		161	5	23		154	42
86		166	11	23		159	50
87		171	21	47		164	52
88		176	5	29		169	58
89		181	21	58		174	58
90		187	6	39		180	0

What things else doe the Cosmographers teach to be considered in Climes and Parallels?

Diuerse things, as first how many Italian miles euery clime hath in breadth and length, also what seasons of the yeare, and what shadowes the sunne yeldeth to those that dwell vnder diuers Climes and Parallels.

What

What breadth and length do the auncient writers appoint to euery one of the seuen Climes.

They appoint such bredth and length as this Table following sheweth, in which also is set downe the degrees and minutes of Latitude, through which the Middle Parallel of euery Clime passeth, and also the number of miles aunswerable to one degree of euery such latitude.

Climes.	miles in bredth.	miles in length.	The degrees and minutes of Latitude, through which the middle Parallell of euerie clime passeth.		The number of miles aunswerable to one degree of euery such Latitude.
			De.	M.	
1	465	20555	16.	37	57
2	420	19453	24	15	54
3	370	18398	30	45	51
4	350	17299	36	24	48
5	270	16215	41	20	45
6	225	15136	45	24	42
7	195	14426	48	40	40

How is the bredth & length of euery Clime to be known?

The bredth is to bee knowne by multiplying the degrées of difference contained betwixt the beginning & end of euery Clime by 60. miles: And if the degrées of difference haue any minutes annexed thereunto, then you must adde so many miles as there be minutes, to the product of the former multiplication. Now to haue the length of euery Clime, you must seeke to know by the Tables of miles, how many miles be answerable to one degree of that Parallell of Latitude, which passeth through the midst of the Clime, and by that number of miles multiply 360. and the product thereof shall bee the length. But if the degree of that Latitude haue any minutes annexed thereunto, then you must finde out the miles of those minutes by the rule of proportion in saying thus: if 60. doe require so many miles, as you founde in the Table of miles, what shall so many minutes require, and adde the quotient thereof to the product of the former multiplication, so shall you haue the true length of the Clime, all which thinges are obserued in the foresaide Table, which table by obseruing like

order

order, you may extend (if you will) to the number of 24 Climes set downe by Orontius and by diuers other moderne writers.

Of the diuers seasons and shadowes incident to diuers Climes and Paralels, and first what seasons and shadows they haue that dwell right vnder the Equinoctiall,

Cap. 19

THose that dwel right vnder the first Clime and especially right vnder the Equinoctial, which people at one instant may see both the Poles, haue two sommers and two winters, for the Sun hauing to passe right ouer their heads twice in the yeare, which is when he is in Aries, and againe in Libra, then they must needes haue two sommers, because the sunne at both those times is nigheſt vnto them, but when he is in Cancer or in Capricorne, then he is furthest frō them, and thereby maketh vnto them two Winters. But yet neither of them so cold as our winter is, wherby it appeareth that our two times of Spring and Autumne are to them 2. sommers, and our two times of sommer and winter are to them two winters.

What shadowes haue those inhabitants?

They haue fiue sundrie shadowes, for when the Sunne is in either of the Equinoxes, they cast their shadow in the morning when the Sunne riseth towards the West. And at night when he goeth downe towards the East, and at noone day they haue no shadow at all, but a perpendicular shadow, which straketh right downe from head to foote, because the sun being then in the Equinoctiall, must needs at that time of the day be right ouer their heads, as you may plainely see in euery material Sphere, hauing a fote with a firme Horizon, and dewly placed to shew a right Spheare but when the Sun is in any place of ỹ Southerne signes, thē the foresaid inhabitants doe cast their shadow towards the North. And when he is in the Northerne signes, they cast their shadowe towardes the South, and because they dwell in a right Spheare, their daies and nights be alwaies equall.

Of

Of the seasons and shadowes which they haue that dwell betwixt the Equinoctiall and tropique of Cancer.

Cap. 20.



These haue also two sommers and two winters and 5. shadowes like vnto the others because the sunne passeth twice in the yeare right ouer their heads, first in his declining from the Equinoctiall towards Cancer, and againe in his returning from Cancer towards the Equinoctiall, vnder which Clime Arabia fœlix is said to be situated. For Lucan writeth that the Arabians comming to Rome to aide Pompey, marualled much to see that the trees did neuer cast their shadowes on the left hand, because in their countrey their shadow is sometime on the right hand, and sometime on the left, sometime perpendicular, sometime orientall, and sometime occidentall, but in Rome and in al other places beyond the Tropique of Cancer the shadow alwaies at noonetide tendeth Northward, the words of Lucan be thus, Ignotum vobis Arabes venistis in orbem, vmbras mirati nemorum non ire sinistras.

How is Lucan to be vnderstood here in vsing this speach on the left hand?

As al other Poets are, for they hauing regarde to the West, doe alwaies make the North part their right hand, & the South part the left. But the Astronomers hauing regard to the south, do make the West their right hand, and the East their left hand: againe the Geographers contrariwise hauing regarde to the North, do make the East their right and the West their left hande. whereby you may see that the right hand and left hand may be taken three manner of waies, that is according to the manner of the Poets, of the Astronomers, and of the Geographers.

Sith these inhabitants haue seasons and shadowes like to those that dwelt right vnder the Equinoctial, wherein then do they differ?

They differ in that their daies and nightes be not alwaies equal by reason that their Horizon declineth from the poles of the world. and by cutting the Parallels of the sunne with oblique Angles it deuideth those Parallels into vnequall partes, neither can their

two

two sommers be so extreamly hotte as the others, because the Sunne for the most part is further from them.

Of the seasons and shadowes which they haue that dwell right vnder the Tropique of Cancer.

Cap. 21.

They haue but one sommer and one winter, by reason that the Sun neuer passeth right ouer their heads but once in the yeare, and that is whē he entreth into the first degree of Cācer: In which time when the Sunne riseth, the shadow tendeth towards the West, & at noone the shadowe is perpendicular enclining on neither side, but falling right downe. And at night when the sunne goeth downe, the shadow tendeth towards the East: and at all other times of the yeare the shadow at noonetide falleth alwaies Northward, & as touching their daies and nights, they shorten and lengthen according as the Sunne either approcheth towards Cancer, or retireth towards Capricorne.

Of the seasons and shadowes which they haue that dwell betwixt the Tropique of Cancer and the Circle Arctique.

Chap. 22.

They haue also one sommer and one winter as we haue here in England, for the sunne neuer passeth right ouer their heads, by reasō that so soone as he hath made his last & highest Parallel in Cācer, he returneth againe Southward, and therefore their shadow is neuer at noonetide perpendicular but shooteth Northward, and the daies and nights do lengthen & shorten according as the sunne maketh his course either through the Northerne or Southerne signes. For whilest he passeth through the Northerne signes the daies are longer then the nights, and in passing through the Southerne signes he maketh the nights longer then the daies.

Of the seasons and shadowes which they haue that dwell right vnder the Circle Arctique, and how long their day is.

Cap. 23.

They haue but one Winter and one Sommer, and their shadow alwaies tendeth sidelong toward. And because their Zenith being in the circle Arctique, is at all times of the yeare all one with the Pole of the Zodiaque: the Ecliptique line therefore must needes be all one with their Horizon, whereby the one halfe of the Zodiaque in a very moment doth rise aboue the Horizon, and the other halfe in the same instant goeth downe, and as the whole Tropique of Cancer appeareth alwaies aboue the Horizon: So the whole Tropique of Capricorne is alwaies hidden vnder the Horizon, so as when the sunne entreth into the first degree of Cancer, their day is 24. houres long & their night but a moment, so contrariwise when the Sun entreth into the first degree of Capricorne, their night is 24. houres long, and their day but a moment, as you may plainely see by placing the Spheare at the 66. degree and 30. of Latitude.

What seasons, shadowes and length of day they haue that dwell betwixt the Circle Arctique and the pole Arctique.

Cap. 24.

These haue like seasons and shadowes as those that dwell vnder the Circle Arctique, sauing that their Winter is colder and longer, because the nigher they approch to the Pole, the further are they from the Sunne, and also haue both longer daies and nights, for the more that the Pole is eleuated aboue their Horizon, the greater portion of the Zodiaque doth alwaies appeare aboue the same, which portion if it containe one whole signe, then their day is a moneth long, and their night as much, if two whole signes, then their day is two moneths long, and their night as much, and so forth as hath beene said before.

Of

Of thoſe that dwell right vnder the Pole.

Cap. 25.

WHat ſeaſons, ſhadowes, & length of day haue they that dwell right vnder the Pole, if there be any ſuch people?

Truly you doe well to doubt thereof, for in mine opinion humane nature is not able to ſuffer the extreame cold that by reaſon muſt nedes be in thoſe parts, neither doe I thinke that euer any man either Chriſtian or Heathen did euer ſayle ſo farre as to diſcouer any land there. Notwithſtanding if there be any ſuch people their ſeaſon is alwaies ſo extreame cold as no part thereof is worthy to be called a ſommer, but rather a continuall winter, and as for their ſhadow ſith the Sun when he is at the higheſt doth neuer mount aboue their Horizon more then 23. degrees 30. at the moſt, their ſhadow muſt nedes goe round about them nigher, for the moſt part to their feete then to their heads, for the Pole is their Zenith, and the Equinoctiall their Horizon, whereby 6. ſignes which is the one halfe of the Zodiaque, doth alwaies appeare aboue their Horizon, and the other halfe is alwaies hidden vnder their Horizon, & thereby they haue 6. moneths day & 6. moneths night, day I ſay whileſt the ſunne is in the 6. Northerne ſignes, & night whileſt the ſunne is in the 6. Southerne ſignes, and yet the night can not be ſo darke there as elſe where, by reaſon that the ſunne is neuer diſtant from their Horizon aboue 23. degrees 30. which is only when he entreth into the firſt degree of Capricorne. So likewiſe the day with them can neuer be ſo cleare as elſwhere, by reaſon that the ſunne mounting no higher aboue their Horizon then 23. degrees 30. which onely is when he entreth into the firſt degree of Cancer, hath no power to diſſolue their groſſe, thicke, cloudie and miſtie aire, yet haue they ſome preheminence in that they may (if their cloudy aire be not the let) alwaies ſee all the fixed ſtarres that are placed in the ſky betwixt the Equinoctiall and the Pole, becauſe they neuer goe downe but are alwaies remaining aboue their Horizon: whereas in all other partes of the world, the ſaid ſtarres can not be ſeene all at once, for that they both riſe and ſet, more or leſſe in number according as the Zenith of the inhabitants of euery place is more or leſſe diſtant from the Equinoctiall.

By what names certaine inhabitants of the earth are called as well according to the diuersitie or likenesse of shadowes as of situation.

Chap. 26.

YOu shall vnderstand that according to the diuersitie or likenesse of shadowes, the auncient Cosmographers haue giuen to the inhabitants certain Greeke names, wherof some are called Amphiscii, some Heteroscii, and some Periscii.

Shew what these names doe signifie?

Amphiscii be those that cast their shadowes both waies, that is sometimes towardes the North, and sometime towardes the South, as those that inhabite the burnt Zone.

Heteroscii be those that cast their shadow onely one way, as those that dwell in either of the temperate Zones, for if they dwell in the North temperate Zone, they doe cast their shadow alwaies at noontide towards the North. And if they dwell in the South temperate Zone they cast their shadow at noontide towardes the South.

Periscii are those that cast their shadow round about them as those that dwell in either of the colde Zones to whom the Pole is their Zenith: Againe they giue them certaine names according to the diuersitie or likenes of their situation and of the seasons incident to those places, whereof some are called Antœci, some Perioeci, and some Antipodes siue Antichtones.

What doe these names signifie?

Antœci be two sundrie Nations, the one dwelling towardes the North Pole, and the other towardes the South Pole, hauing one selfe Meridian and one selfe Latitude, that is to say, be of like distance from the Equinoctiall, the one Southward and the other Northward, as the letters a. b. in the figure following doe shew.

Perioeci be those that dwell in one selfe Parallel, how distant soeuer they be East and West as the letters b. c. in the said figure doe shew.

Antipodes be those that dwell fete to fete, so as a right line being drawne from the one to the other, passeth through the Center of the world as you may see by the Letters a. c. in the figure following.

And



And the first of these called Antœci haue contrarie seasons of the yeare, for when it is sommer to the one, it is winter to the other: Againe Periœci, though they haue like seasons of the yeare, yet because they are so farre distant in length one from another, it is therefore mid-day to the one when it is mid-night to ỹ other. But Antipodes be contrarie in seasons and in all other things, hauing nothing common, more then that they haue one selfe Horizon.

By what names certaine parts of the earth are called by reason of their diuers shapes.

Cap. 27.

NOw besides the foresaid names attributed to the inhabitants of the earth for such respect as is aboue saide, the Cosmographers doe giue also to diuers parts of the earth according to the diuers shapes therof diuers names also: for if any part of the earth bee enuironed round with water either salt or fresh, it is called Insula, that is an Iland, as England, Ireland, and such like, but if the water goe round about it sauing in one part, then it is called peninsula, that is to say, almost an Iland, as Denmarke, Italye, Morea, and such like, & if it be a narrow straight encloled with the sea on both sides, then it is

called Isthmus as the narrow straight of Cornith lying betwixt Boetia and Achaia in Greece which diuers Emperours of Rome haue in vaine attempted to cut, to the intent to make there through a nauigable passage: finally, when it is neither insula, peninsula nor Isthmus: then it is called Continens, that is to say firme land, as Saxonie, Boemia, Sueuia, and such like, but these bee special continents, for the Cosmographers of these daies doe make but three generall continents, that is first so much as was knowne to Ptolomie, & to the rest of the auncient writers, secondly the West Indies, lately found out, and thirdly the South part of the world not yet wholy discouered: Againe the auncient men deuided that portion of the world, which was knowne in their daies into three parts, that is, Europe, Asia, and Afrique, whereunto the moderne writers haue added a fourth part called America, containing the west Indies. Now if you would know what kingdomes, Regions, Citties, Townes, Seas with their Hauens, Ports, Bayes, and Capes, Iles, Floods, Marishes, and Mountaines, are contained in euery one of these foure partes, then peruse often the vniuersall Maps, and Terrestriall Globes, as well of the moderne as of the ancient writers, and also the Tables of Ptolomie and of Ortelius, which I wish that they had beene made in such forme as the Tables of Ptolomie are: for hauing the North alwaies set in the front, it should be the readier to compaire the shape or situation of any place or Region to the vniuersall Mappe, and by knowing the Longitude and latitude of any place, it should be the easier to find the same, as well in the special Tables as in the vniuersall Map or Globe. The vse of which vniuersall Maps, I haue already written in a seueral Treatise by it selfe printed not long since. But now for so much as the knowledge of the windes hath beene alwaies thought a thing meete to bee treated of by him that writeth of Cosmography, and specially of the Spheare, I will here speake somewhat of them, neither do I mind to make any great discourse thereof, as naturall Philosophers are woonte to doe, but onely to define what the winde is, & to shew into how many parts the same is deuided, as well by the auncient as moderne writers, and by what names they are called and somewhat of the qualities thereof

Of

Of the winde, what it is, what motion it hath, and of the diuers names and diuisions thereof.

Chap. 29.

FIrst then you haue to vnderstand that Aristotle and the rest of his sect, doe define the wind to be an exhalation hotte and dry, engendred in the bowels of the earth, and being gotten out, is caried sidelong vpon the face of the earth.

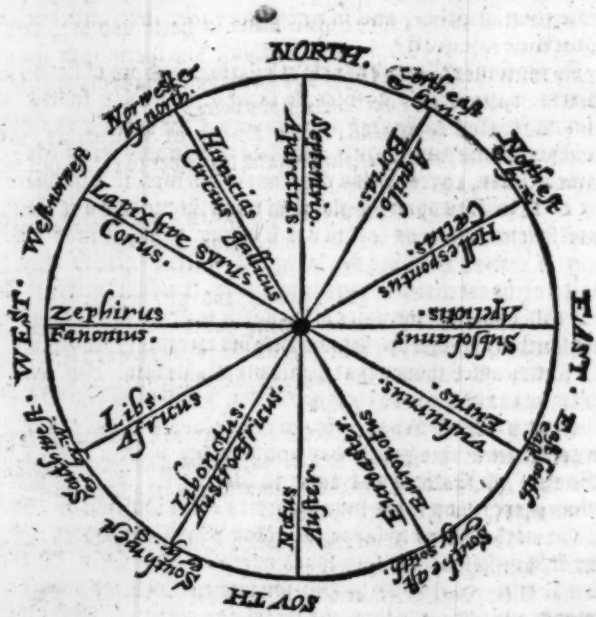
Why is not his motion right vp & down, aswell as sidelong?

Because that whilest by his heat he striueth to mount vp, and to passe through all the three Regions of the aire, the middle Region by his extreame cold, doth alwaies beate him backe, so as by such strife & by the meeting of other exhalations rising out of the earth, his motion is forced to be rather round then right.

What is the cause why he bloweth more sharpely at one time then another, and in one place more then another, and sometime not at all?

As the fumes that rise of new exhalations, and out of floods and waters, may encrease his force, so lacke of heate and fumes doth diminish the same. Againe the roundnes of the earth is cause that he bloweth sometime more in one place then in another: also mountaines, hilles, & great woods may hinder his force in some place of the earth wheras vpon the plaine or vpon the broad sea he bloweth most sharpely, and as for his not blowing at all, it may chance diuerse waies, as either for lacke of sufficient heate to open the pores of the earth to let himselfe out, or for that some extreme frost and cold doth close the pores of the earth so strait that he can not get forth, or for that the Sunne with his extreme heate consumeth the fumes and vapours that should maintaine him. But leauing to answere any more to these questions, I will shew you how many windes were obserued by Saylers in olde time, and how many are obserued at this present day, and how they were named. True it is that all Nations doe agree in placing the foure principall windes, according to the foure quarters of the Horizon or Angles of the world, that is to say, East, West, North and South: but in the subdiuision of the said foure quarters they differ, for some deuide euery quarter of the Horizon into two, making onely eight winds, and some into three, and thereby do make 12. winds which

the auncient Grekes and the Romaines did chiefely obserue, the names of the 8. winds are commonly expressed in the Italian tong thus: Thramontano, North, Mezzodi, South, Leuante, East, Ponente, West, Griego, Northeast, Garbino, Southwest, Maistro, Northwest, Syrocco, Southeast, which names are often vsed by Christopher Columbus, Albertus Vesputius, and others that sayled first into the East and West Indies, and if you will know the names of the 12. windes vsed by the ancient Greeks and Romaines, then behold this figure here following wherein you shall find them set downe in English, Greeke, & Latine, that is to say, the English names without the Circles, and the Greeke and Latine names within the Circle, the Greeke vpon the right side of euery line pointing the winde, and the Latine name vpon the left side of euery such line.



Of the nature and qualities of the foreſaide 12. windes.

Cap. 29.

THe Northwind called Septentrio or Aparctias is extremely colde and drie, prohibiting raine, it preſerueth health by cleanſing the Ayre of all peſtiferous infections, but it cauſeth drie colds, & hurteth the fruites and floures of the earth.

2 The Northeaſt and by North, called Aquilo or Boreas, is alſo cold & dry without raine, it hurteth ꝑ flowres and fruits of the earth, and eſpecially the Vines when they bud.

3 The Northeaſt and by Eaſt, called Helleſpontus or Cæcias, is hotte drying vp all things.

4 the Eaſt winde called Subſolanus, is hotte and dry, temperate, ſweete, pure, ſubtile, and healthfull, and ſpecially in the morning when the Sunne riſeth, by whome he is made more pure and ſubtill, cauſinge no infection to mans body.

5 The Eaſt Southeaſt, called Eurus or Vulturnus, is alſo hotte and drie, he bloweth lowde, and therefore is called of Lucretius, Altitonans vulturnus.

6 The Southeaſt and by South, called Euroaſter, or Eurono tus, is hotte and moiſt, and bréedeth cloudes and ſicknes.

7 The South wind called Auſter or Notus, is hotte and moiſt bréeding thicke cloudes, great raines, and peſtiferous aire.

8 The Southweſt and by South called Auſtro aphricus, is temperately hotte, and yet bréedeth ſicknes, & raine as ſome write.

9 The Southweſt and by Weſt, named Aphricus or Libs, is colde and moiſt, cauſing raine.

10 The Weſt winde, called Fauonius, or Zephirus is temperately hote and moiſt, and wholeſome in the Euening, it diſſolueth froſt, yce, and ſnow, and maketh flowres and graſſe to ſpring, and ſome write, that it cauſeth thunder.

11 The Weſt Northweſt, called Corus or Syrus, is colde & moiſt, without any great rigour.

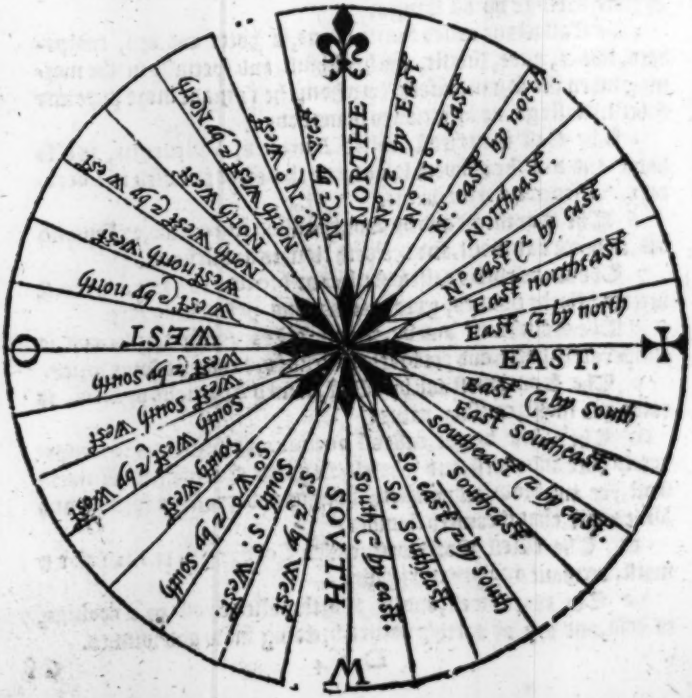
12 The Northweſt, and by North, called Syrus or Trachias, is cold, and dry of earthly nature, bréeding ſnow and windes.

Of the moderne deuision of the windes.

Cap. 20

BVt the Mariners of these our latter daies, to bée þ better assured of their routes and courses on the sea, do deuide euery quarter of the Horizon into 8. seuerall windes, so as they make in all 32. windes which of the Spaniards are called Rombes, which windes together with their names, you may see plainly set foorth in this figure following representing the Mariners Compasse.

A figure of the 32. windes representing the Mariners Compasse.



And note that eight of theſe winds are called principall winds, that is Southe, North, Eaſt, Weſt, Northeaſt, Southweſt, Northweſt, and Southeaſt, and all the reſt are called Collaterall windes, but the firſt foure are chiefeſt, from whence the names of all the reſt are deriued, neither doe the learned Pilots in their Tables call the firſt foure windes, Rombes, but will ſay the firſt, ſeconde or third Rombe from North, from Eaſt, South, or Weſt, vnto the number of ſeuen, for ſo many Rombes they make in euerye quarter betwixt the foure chiefe and principall windes. of which matter I ſhall ſpeake here after in my treatiſe of Nauigation. In the meane time I heartily pray all thoſe that ſhall vouchſafe to reade this my treatiſe of the Spheare, to take my labour therein beſtowed in good part, and where any fault is, friendly to correct the ſame without any ſcorne or diſdaine.



A plaine deſcription of Mercator his two Globes, that is to ſay, of the Terreſtriall Globe and *of the Celeſtiall Globe, and of either of them,* Together with the moſt neceſſarie vſes thereof, written by M. *Blundeuill.*

Whereunto is added a briefe deſcription of the two great *Globes lately ſet foorth by* M. Molinaxe: *and* of Sir *Frances Drake* his firſt voyage into the Indies.



He telleth the number of the ſtarres and calleth them by their name. Pag. 147.

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BRITISH MUSEUM

A plaine deſcription of the two Globes of *Mercator*, that is to ſay, of the Terreſtriall Globe, and of the Celeſtiall Globe, and of either of them, together with the moſt neceſſarie vſes thereof and firſt of the Terreſtriall Globe

written by *M. Blundeuill*..

The Terreſtriall Globe is a round body couered with an vniuerſall Map containing both ſea and land, which is deuided by the later Coſmographers into foure principall parts, that is Europe, Affrique, Aſia, and America, the Longitude and Latitude of euery which part is already ſet down in my deſcription of vniuerſal Maps and Cardes. And in this Globe are alſo ſet downe certaine ſtars ſome towards either of the poles, & ſome nigh to the Ecliptique line, whereof we ſhall ſpeake hereafter when we come to treate of the Celeſtiall Globe. But you haue to vnderſtand that the one end of this Globe is called the pole Arctique, that is to ſay, the North pole, and the other ende the pole antarctique, that is to ſay, the South pole: vppon which two poles it is turned about. And this Globe is traced with certaine circular lines, whereof ſome bee greater and ſome leſſer, thoſe greater which paſſe through both the poles, are called Meridians of this word Meridies, which is as much to ſay as noonetide, for when the Sunne toucheth any of thoſe Circles, it is noonetide to all thoſe that dwell right vnder that Circle, of which Meridians though you may imagine to bee halfe ſo many as there bee degrees in the Equinoctiall, which amounteth to the number of 180. yet there are ſet downe in this Globe no more but twelue which doe cut the Equinoctiall in 24.

points

points, making thereby 24. spaces, euery space containing 15. degrees of the Equinoctiall, which 15. degrees doe make one houre, for y Equinoctial is a great circle which guirding the globe in the very middest betwixt the two Poles, and representing the motion of the first moueable, maketh his dayly reuolution from East to West in foure and twenty houres. And this great Circle by deuiding the Globe into two equall parts, causeth the same to haue two Latitudes or breadthes, the one Northerne and the other Southerne, for that space of the halfe Globe which lieth betwixt the Equinoctiall and the Norths Pole, is called the Norths Latitude, and the other halfe of the Globe which lyeth betwixt the Equinoctiall and the South Pole, is called the South Latitude, each Latitude containing euery where from the Equinoctiall to either of the Poles nintie degrees. Againe this Circle is deuided into 360. degrees containing the whole Longitude of the earth, and euery degree is 60. Italian miles, which being multiplyed into 360. maketh in all 21600. miles, and such Longitude is to be counted from West to East, beginning the same at the first Meridian which passeth through the Iles of Canaria, otherwise called Insulæ fortunatæ, crossing the Equinoctiall and the Ecliptique line, in the first degree of Aries, and also in the first degree of Libra, which are the two Equinoctiall points, so as the one halfe of the Equinoctiall which goeth from West to East, containeth 180. degrees, and the other halfe returning againe from East to West containeth also 180. degrees, which maketh in all 360. degrees, ending where the first degree, of Longitude did begin: For though Mercator and others in their seuerall Maps doe in these dayes make the first Meridian to passe through the Iles Azores which are fiue degrees more to the West. Yet Mercator in his great Terrestriall Globe dedicated first to the Lord Granuella, and afterwards to the Emperour Charles the fift Anno Domi, 1541. placeth the first Meridian as before is saide, both whose Globes my Worshipfull friend Sir Thomas Knyuet of Ashwelthorpe Knight, did courteously lend me I thanke him, who as he is verie well learned in all the liberal Sciences himselfe, so is he a great fauourer and furtherer of all such as delight in any learned or vertuous exercise: And by helpe of those Globes I wrot

this

this Treatiſe. But to returne to my matter, there is another great ſloping and ouerthwart Circle, called the Ecliptique line, vnder which the Sunne continually walketh, and this line is marked with the Characters of the twelue ſignes, euery ſigne containing in length thirtie ſuch degrees as the Equinoctiall hath, ſo as in all, the Ecliptique line containeth 360. degrees, which is the Longitude of heauen, and the firſt degree of the Longitude of any ſtarre beginneth at the firſt point of Aries, and endeth at the ſame point. Now of the leſſer Circles there be foure principall, that is, the two Tropiques, that is to ſay, the Tropique of Cancer towards the North pole, and the Tropique of Capricorne towards the South Pole, betwixt which two Tropiques, the Sun continually goeth right vnder the foreſaid Ecliptique line, neuer mounting higher then the Tropique of Cancer, nor deſcending lower then the Tropique of Capricorne. Of the other two leſſer Circles, the one is called the Circle Arctique enuironing the North Pole, and the other the Circle Antarctique enuironing the South pole: all which foure Circles are called Parallels, that is to ſay, equally diſtant one from another, and by reaſon of theſe foure Circles, the Globe is deuided into fiue Zones, that is to ſay, two cold Zones, two temperate, and one extreamely hotte: of the colde Zones, the one lyeth betwixt the Circle Antarctique, and the South Pole, and the other betwixt the Circle Arctique and the North Pole.

And of the temperate Zones, the one lyeth betwixt the Tropique of Cancer and the Circle Arctique, and the other lyeth betwixt the Tropique of Capricorne and the Circle Antarctique. The hotte Zone is that which lyeth betwixt the two Tropiques, through the middeſt of which Zone palleth the foreſaid Equinoctiall line, right vnder which, they that dwell, haue no Latitude at all, and therefore their daies and nights are alwaies equall, (that is to ſay) twelue howres day, and twelue houres night. Alſo beſides theſe foure foreſaid leſſer Circles or Parallels, the Globe is traced with eight other Parallel Circles on the each ſide of the Equinoctiall towards either of the poles, making on each ſide nine equall ſpaces, euery ſpace containing ten degrees of the Equinoctiall, ſo as they doe make in all 90. degrees, which is a

quarter.

quarter of the great Circle. Moreouer there be certaine Mariners Compasses deuided into 32. Circular lines signifying the 32. windes, whereby Mariners doe saile, and do direct their ships from port to port, which lines doe diuersely crosse the other Circles before rehearsed. Besides these Circular lines before described, there is fastned vnto the two Poles of the Globe, a Meridian of brasse cõmonly called the moueable Meridian within the which the Globe turneth about, and this Meridian is deuided into foure quarters euery quarter containing 90. degrees, so as the whole circuit thereof is 360. degrees, one of which quarters towards the North Pole is deuided with circular lines into three seuerall spaces, in the first and lowest whereof being next to the body of the Globe, are set downe the numbers of degrees of Latitude. In the next space aboue that, are grauen the Parallels and numbers of houres of the longest day in euery Latitude, and the spaces of euery houre are deuided with little strokes into foure parts, signifying the foure quarters of an houre: and these houres doe encrease till you come to 24. houres, and from thence the day increaseth by monethes, from one to sixe, ouer which is grauen this Latine word Menses, (that is to say) monethes, and the third and vppermost space containeth the Climes, beginning at one, and so proceedeth to 8. The like Climes, Parallels, and houres of the longest day, are to be accounted also in the said Brazen Meridian proceeding from the Equinoctial towards the South Pole, though they be not there set downe. And vpon this Brazen Meridian is placed at the North pole another little Brazen Circle together with his Inder called the houre wheele, euery halfe whereof containeth twelue houres, the Inder of which wheele being set vpon the North Pole turneth about as the Globe turneth, and yet you must imagine the Pole it selfe to be immoueable. Also there is a quarter Circle of thinne Brasse plate, deuided into 90. degrees fastned in such sort vpon the Brazen Meridian, as you may remoue it to and fro, yea and also take it cleane off if you will, which quarter Circle hath a square head of brasse, signifying the Zenith or verticall point of any place, and this Circle is called the quarter of altitude, which quarter is deuided into 90. degrees, proceeding from the Horizon vpward to the Zenith, where-

by

by may be described vpon the Globe the 90. Almicanterathes or Circles of Altitude. And this quarter serueth for diuers purposes, as to find out thereby the altitude of any starre or point of the Ecliptique line, or of any other point in heauen, and the very edge thereof on the right hand, sheweth the Azimuth or verticall Circle of any place, and in what coast and part of heauen any star is. Also how any place of the earth beareth one from another as you shall more plainly perceiue hereafter by the examples of certain propositions thereto belonging. Then there is another Circle of brasse plate somewhat thicker called the semi-Circle of position, which serueth chiefly for matters of Astronomie, as to find out ỳ twelue houses of heauen, and is to be fastned on the Horizon, so as it may be remoued and set vpon which side of the Globe you will. Also there belongeth to the Globe a little round squire of brasse, made with right Sphericall Angles, the head or stile whereof is to shew the shadow of the Sunne being set vpon the Globe, in stead whereof a needle being set right vp, will sometimes serue the turne. Finally to the Globe belongeth another circle called the Horizon, which is a broad Circle of wood, hauing a foote of wood, within which Horizon, the Globe together with the brazen Meridian is to be set at what altitude you list. And this Horizõ is diuided with diuers circular lines into seuen vnequall spaces, whereof the first & narrowest space next vnto the body of the Globe, containeth the degrees of the 12. signes of the Zodiaque, euery signe cõtaining 30. degrees. The second space containeth the Characters & names of the said signes, and also the number of the degrees, as 10. 20. 30. The third the daies of euery moneth. The fourth ỳ names of euery moneth, and of certaine Festiuall daies. The fift, the names of the twelue windes, which the auncient Grekes and Romaines were wont to obserue, whereof I haue already spoken in my Sphеare. The sixth and seuenth doe shew the 12. houses, together with their significations necessary for the setting of figures and calculating of nativities, and in the foote of the said Horizon is a little Compasse with a needle to shew the North & South, according to which the Globe is to be placed. But yet not before the said needle be truely rectified, according to the variation which it hath in that place where you are to vse the Globe: for otherwise the needle may cause great

erroꝛ, whereof you shall treate in the next Chapter. Thus hauing briefely described the Terrestriall Globe, and all the parts thereof, I thinke it good now to shew you how to place the Globe accoꝛding to the foure quarters of the woꝛld.

This Treatise of the two Globes, containeth 50. *Propositions as followeth.*

HOw to place the Globe truely, according to the foure quarters of the world, and according to the Latitude of any Region. Proposition. 1.

To know vnder what Clime any place or Region is, and how many houres the longest day is there, and also what Latitude any place described in the Mappe hath. Proposition. 2.

How to know what *Longitude* any place described in the Mappe hath. Prop 3.

How to know the distance betwixt any two places described in the Mappe. Prop. 4.

To know how one place beareth from an other. Prop. 5.

How to find out by the Globe the place of the Sunne, that is to say, the degree and minute of that signe wherein the Sun is euery day throughout the yeare. Propo. 6.

How to rectifie the Index of the houre-wheele for euerie seuerall day throughout the yeare. Prop. 7.

How to know euery day at what houre the Sunne riseth or setteth. Prop. 8.

How to know in what part of the Horizon the Sunne riseth and setteth euery day. Prop. 9.

How

How to know the length of euery day & night throughout the yeare as well by helpe of the houre-wheele, as by counting the degrees vpon the *Horizon*. Prop. 10.

How to know by the Globe how much the Sun declineth euery day throughout the yeare from the Equinoctiall. Propoſition, 11.

How to know by the Globe the Meridian altitude of the Sunne, that is to ſay, his hight at noonetide euery day throughout the yeare, and how far hee is then diſtant from your Zenith. Prop. 12.

How to know the altitude of the Sun at euery other houre of the day. Prop. 13.

How to know the houre of the day by the Globe. Propoſition. 14.

To know how much the vnequall houres otherwiſe called the Planetary houres, doe differ from the artificiall houres throughout the yeare, and how many minutes euery vnequal houre containeth. prop. 15.

How to knowe euery day when the dawning of the day, & the twilight of the night beginneth and endeth, and the time of their continuance. prop. 16.

How to know the aſcention of the Sunne, both right and oblique. prop. 17.

The 18. propoſition, containing the diſcription of the Celeſtiall Globe, and ſhewing wherein it is like or differing from the terreſtriall Globe.

The 19. propoſition containing a particular deſcription of the 48. Images of the fixed ſtarres that are in the Celeſtiall Globe, together with their ſundrie names, and alſo the names of ſo many ſtarres as are named in the Globe prop. 19.

How to finde out in heauen any vnknowne ſtarre deſcribed in the Globe two manner of waies, that is, either by the helpe of ſome knowne ſtar, or elſe by knowing the true houre of the night. prop. 20.

How to knowe by the Globe the Meridian altitude which is the higheſt altitude of any ſtarre, and alſo how high or low he is at any other time. prop. 21.

How to know by the Globe what ſtarres are aboue the Horizon at any time of the day or night. *Prop.* 22.

How to know by the Globe at what time any ſtarre riſeth aboue the Horizon, mounteth to the higheſt, and ſetteth: and with what degree of the Ecliptique hee ryſeth, mounteth, and ſetteth: and alſo in what part of the Horizon he riſeth and ſetteth. Prop. 23.

How to know in what part of the firmamēt, any ſtar is, and how many degrees it is diſtant frō the Meridian at any houre, and being right vnder the Meridian to know how far it is diſtant from your Zenith. Prop. 24.

How to find the houre of the night by the Globe. Prop. 25.

How to know the verticall ſtars in euery Latitude. Prop, 26.

How to know the true place of any ſtar, that is to ſay, in what ſigne and in what degree thereof any ſtar is. Prop. 27.

How to finde the place and Longitude of any ſtarre by the Globe. *Prop.* 28.

How to find out the Latitude of any ſtarre. Prop. 29.

How to find out by the Globe, the declination of any ſtar: Prop. 30.

How to know the magnitude or greatnes of any ſtar, and his nature and quality by the Globe, and alſo the right aſcention of the Arque of the Ecliptique, which accompanieth the right aſcention of any ſtar. Prop. 31.

A Table of the fixed ſtarres.

How to find out the right and oblique aſcention of any ſtar and alſo of the aſcentionall difference. *Prop.* 32.

To know in what quantitie of time any whole ſigne or any other Arque of the Ecliptique doth riſe or ſet. Prop. 33.

How to know by the Globe what ſtars doe riſe or ſet euery day Coſmically, Acronically, Heliacally, Prop. 34.

To know in what time of the yeare any ſtar riſeth or ſetteth either Coſmically or Acronically. prop. 35.

Of the Horoſcope and the reſt of the 12. houſes. Prop. 36.

How to find out the Horoſcope or aſcendent at any time of the day or night by the Globe, and thereby to know the foure principall Angles of heauens. prop. 37.

How

How to erect a figure by a globe according to *Regio Montanus* his way, which is called the reaſonable way, and is counted the beſt of all others. Prop. 38.

How to know the Latitude of any place or region by any of the fixed ſtars deſcribed in the Globe. Prop. 39.

Another way to find the eleuation of the Pole. Prop 40.

A third way how to find out by 2. ſtars the eleuation of the pole, not knowing their Meridian altitude. Prop. 41.

A fourth way to find out the Latitude of any Region by any knowne fixed ſtarre or Planet that may be ſeene. Prop. 42.

A briefe deſcription of the diurnall Table ſet down in *Stadius* his Ephemerides, together with the vſe thereof. Prop 43.

How to find out the place of any planet by the Ephemerides. Prop. 44.

A briefe deſcription of the Table of *Stadius*, ſet downe in the 112. Page of his Ephemerides, to finde out thereby the dayly Latitude of the Moone be it North or South, together with the Canon or rule thereof, plainely declared by example. Prop. 45.

How to know the true place of the Sunne or Moone or of any other Planet euery hour of the day throughout the yeare. Prop. 46.

How to find out the place of the Moone by the Globe when ſhe is aboue the Horizon, without the helpe of any Ephemerides or other Table whatſoeuer. Prop. 47.

Another way to finde out the place of the Moone without taking the latitude of any ſtarre. Prop. 48.

How to find out the Longitude of any region. Prop 49.

Another way to find out the vnknowne Longitude of any place by the Globe. Prop. 50.

How to place the Globe truly according to the foure quarters of the world, & according to the Latitude of any region.

The 1. Propoſition.

FIrſt in bedding your Globe together with the Brazen Meridian in the two nickes of the Horizon and alſo in the ſlit of the pinne which ſtandeth in the middeſt of the ſoote, ſo that the North pole of your Globe be anſwerable to the North quarter or North wind of the world, deſcribed vpon the Horizon, and ſee that that part of the Brazen Meridian, wherin are deſcribed ẏ Climes, Parallels and houres of the longeſt day, may ſtand aboue the Horizon, and alſo that the one halfe of the brazen Meridian may iuſtly and euenly appeare aboue the Horizon, and the other halfe vnder the Horizon: Againe, you muſt ſee that the Equinoctiall line of the Globe doe meete iuſt with the middle point or ſtreke of the brazen Meridian whereas the firſt degree of Latitude doth begin and alſo that the body of the Globe doe not leane to the one ſide of the Horizon more than to the other, but to be equally diſtant from the ſame in all places, & in any wiſe to ſee that the Horizon ſtand alwaies leuel, to which end ſome Globes haue a plummet of leade hanging by a little chaine or threede, which becauſe it will moue with euery wind, I for my part doe thinke it better for you to haue ſuch a little leuell made of purpoſe, as you may ſet the ſame vpon any place of the Horizon where you liſt, & thereby make ẏ Horizon to ſtand leuell on euery ſide as you will



your selfe, and it may be made of a little peece of thicke boorde, like a Triangle, thus.

Then with your two hands laying hold of the two next pillers, turne the foote of the Globe vntill it stand right North and South which is to be done thus. First finde out the true Meridian of the place whereas you are to vse the Globe by such meanes as Master Burrough teacheth in his discourse of the variation of the Compasse, the 7. Chapter, which vndoubtedly is a most certaine way, by which you shall finde three thinges at one instant, that is, the true Meridian, the variation of the needle, and the true Latitude of any place. But if you haue not the instrument of variation, by helpe whereof this matter is to bee accomplished, then in some open place betwixt 8. and 9. of the clocke in the forenoone or sooner, vpon a smooth Table or plancke, standing leuell, drawe a good large Circle with your Compasses, in the Center whereof must bee fixed a round and straight pinne of Iron or Latton wyer, in length a good deale shorter then the Semidiameter of that Circle and to the intent that the pinne or stile may stande right vp, without inclining on either side, it would be rectified by a true Squire. That done, waite deligently vntill the shadow of the pinne heade doe iustly touch the circumference of the Circle, so as it neyther passe beyond the Circle, nor come short of the same, and there make a pricke, and so let it stay vntill about three of the clocke in the afternone, about which time the shadow of the pinne will beginne to approch nigh vnto the saide Circle, and so soone as it toucheth the same, make there another pricke: that done, deuide the Arke or portion of the Circle, contained betwixt those 2. pricks into two equall parts, and in the midst thereof set another pricke, then laying your ruler to the middle prick, and to the Center of the Circle, drawe a right line through the Center and also through the middle pricke from the one side of the Circle to the other, and beyond if you list: for you may make the saide line of such length as you shall thinke most meete to serue your turne, and that line shall be the true Meridian for that place, shewing the right North and South part of your Horizon, and by crossing the saide line with another right line in the very middest with right Angles, you shall haue the true East and West, and to auoyde long wayting, you may draw diuerse Circles one with in another. Thus hauing

uing found the true North and South, East and West, place your Globe accordingly, so as the Brazen Meridian of the Globe may aunswere the Meridian line alreadie drawne vpon the boorde or plaine, and to the intent that afterward you may knowe at all times both day and night, how to place your Globe right North and South, it shall be necessarie to drawe a right line vppon the foote of the Horizon, aunswereable to the foresaide Meridian first drawne vpon the boorde or plaine, and vpon that line to fasten a prettie handsome Compasse, having a needle of an inch long at the least, which is much more certaine, than such a little neevle as is woont to bee set in the foote of euery globe: And when the needle standeth still, marke how much the North point thereof declineth eyther East or West, from the true Meridian before taken, and whereas you see the Needle to decline, bee it East or West, there set fast a little pinne of Latton to serue as a marke, whereto you may alwaies direct the North point of the needle when you would haue the Globe to stand right North and South, for there is no needle touched with the loade-stone, bee it neuer so good a stone, but it will varie from the true Meridian line, either more or lesse, and therefore no trust is to be giuen to the needle vntill you know the true variation thereof, the finding of which variation, as I saide before, is most truely taught by W. Borough in his Booke before mentioned, whereunto I once againe refer you, and the rather for that it is written in our mother tongue. But Gemma Frisius teacheth to set the Globe right North and South thus, first goe into an open place whereas the Sunne shineth, and vpon some Table standing leuel, and also the Globe standing leuell, the Pole being eleuated aboue the Horizon according to your Latitude, fixe a right needle in the degree of the signe, wherein the Sunne is that day, so as the needle may stand right vp without inclining any manner of way, and if it bee in the forenoone, turne the East side of the Globe towards the Sunne, moouing both the Globe and his seate to and fro, vntill you see the needle to cast no shadowe at all, for so shall the Globe stande right North and South. But if it bee in the afternoone, you must turne the West side of the Globe towardes the Sunne, and then worke as before, and by any of these wayes before taught you shall not onely place

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the Globe anſwereable to the foure quarters of the world but alſo you ſhall find that the Circles, Poles, and Arletrees of the Globe are anſwereable to the Circles, Poles, and Arletrees of the heauens. Now hauing placed your Globe anſwereable to the foure quarters of the world, learne to know by ſome Table or moderne Map, or elſe by ſuch waies as are ſet downe both in my Sphere and alſo in the latter end of this treatiſe, the Latitude of the Region wherein you dwell: As for example, the Latitude of theſe partes here about Norwitch is 52. degrees, then taking holde of the Brazen Meridian as well with your left hand aboue the Horizon, as with your right hand beneath the Horizon, turne the ſame vp and downe in the nickes of the Horizon, vntill the North Pole be eleuated aboue the Horizon 52. degrees, the laſt of which degrees muſt meete euen with the vpper brimme of the Horizon, that done, ſeeke for England in the Globe, not leauing to turne the body of the Globe to and fro vntill you haue brought that Meridian which paſſeth through England right vnder the Brazen Meridian, and holding it ſtill at that ſtay, draw the heade of the Brazen quarter of altitude right ouer the place, and ouer that Meridian vnder which you dwell, ſo ſhall the head of your Brazen quarter ſtand for your Zenith in the verie middeſt of the Horizon and keeping all things thus at a ſtay, you may ſee how euery region or countrie is ſituated, and how it beareth from you, and which be vnder your Climate and which be not, and to be ſure that the Brazen Zenith may ſtand in his right place, it ſhall be needful to ſet it ſo as the left ſquare ſide therof made with a long notch may touch the ſelfe ſame degree of Latitude in the Brazen Meridian, which it hath of altitude, for looke how many degrees the Pole is eleuated aboue the Horizon, which is called the altitude, ſo many degrees muſt the brazen Zenith be diſtant from the Equinoctiall of the Globe: which is called Platitude, and is euer all one with the altitude of the Pole. Thus hauing ſhewed you how to place the Globe according to the foure quarters of the world, I thinke good now to declare vnto you, firſt the vſes of the terreſtriall Globe, whereof ſome are common alſo to the celeſtiall globe, as you ſhall perceiue hereafter by the propoſitions following, which propoſitions may be very well deuided into 3. ſorts, whereof the

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firſt doe properly belong to the deſcription of the vniuerſall Map, wherewith the terreſtriall Globe is couered, which are but few in number. The ſecond kinde of propoſitions doe chiefely belong to the Sunne, and to his apparances, which are alſo common to the celeſtiall Globe, and may be found out by either of the Globes. But the third kinde doe belong moſt properly to the fixed ſtarres and to their apparances, and therfore I mind not to ſet down them vntill I come to diſcribe the celeſtiall Globe, and to ſhew the vſes thereof.

The chiefeſt propoſitions belonging to the vniuerſall Mappe, wherewith the terreſtriall Globe is couered, are theſe following.

To know vnder what Clime any place or region is, and of how many houres the longeſt day is there, and alſo what Latitude any place deſcribed in the Map hath.

The 2. Propoſition.

HAuing ſet the Globe at your latitude, bring the place or region which you ſeeke right vnder the Brazen Meridian, and the vpper ſpace of the ſaide Meridian will ſhewe the Clime. And the ſecond or middle ſpace will ſhew the houres of the longeſt day. And the third ſpace the Latitude: As for example, if you woulde knowe vnder what Clime London is, then hauing found London, fixe a long needle in the red ſpot nere to the name of London (for all townes for the moſt part in the Globe are marked with red ſpots) that done, turne the Globe with your hand vntill the needle doe touch the brazen Meridian, and by ſtaying the Globe there with your hand, you ſhall finde London to be vnder the 8. Clime, and that the longeſt day in the yeare is there 16. houres and 20. minutes, and the third and nethermoſt ſpace doth ſhew the Latitude of the place which is 51. degrees, 32. Againe, by obſeruing this order without changing your Latitude you ſhall find Venice to bee vnder the 6. Clime, and their longeſt day to be 15. houres and ſomewhat more, and

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the Latitude of that Cittie to be 44. degrees, 30. and you ſhall find Ieruſalem to be vnder the third Clime, and the longeſt day there to be 14. houres, and the Latitude thereof to be 31. degrees, 30.

How to know what Longitude any place deſcribed in the Map hath.

Propoſition. 3.

THe Globe ſtanding ſtil at your owne Latitude, pricke the needle in the place whereof you ſeeke the Longitude, and bring it as before, to the brazen Meridian, and ſtaying it there, looke at what number of degrees the brazen Meridian cutteth the Equinoctiall, and that is the Longitude of the place, counting ꝑ degrees from the firſt degree of the Equinoctiall, which beginneth at the firſt point of Aries vnto the place of the ſection: by doing thus, you ſhall find the Longitude of London to be 19. degrees, and the Longitude of Venice to be 36. degrees, and the Longitude of Ieruſalem to be 67. degrees and 30. minutes.

How to know the diſtance betwixt any two places deſcribed in the Map.

Propoſition. 4.

OPen your Compaſſes ſo wide as you may ſet the one foote thereof iuſt in the one place, and the other foote in the other place, and apply that wideneſſe to the Equinoctiall line, counting how many degrees of the Equinoctiall are contained betwixt the two feete of your Compaſſes, & by allowing to euery degree 60. miles, you ſhall haue the

true

true distance of the places. Thus you shall finde the distance betwixt London and Venice to be 13. degrées, 30. which being multiplyed by 60. maketh 810. miles, and the distance betwixt London and Ierusalem to be 40. degrées, 30. which being multiplyed by 60. maketh 2430. miles. And it maketh no matter to what part soeuer of the Equinoctiall you doe apply the wideneſſe of your Compasses, so as you set the first foote at the very beginning of some one degrée, and let the other foote fall out as it will, either at a whole degrée, at a halfe, or at a quarter of a degrée, which small parts are to be counted by minutes by coniecturall discretion. And note here that no two places can be distant one from another East and West more then 180. degrées which is iust the one halfe the circuit of the Earth, beyond which halfe or on this side thereof the places must needes be nearer together by meanes of the roundneſſe of the Earth, and if either of the two places whereof you would know the distance be not expreſſed in the Globe, then learne to find out the Longitude & Latitude thereof by some Table, whereof the first Meridian is supposed to passe through the Ilands of Canariæ, & marke vpon the Globe where the said Longitude and Latitude doe crosse, for there ought that place to stand which is missing, to which place direct the one foote of your Compasses and then worke as before is taught. And by this meanes you may also know the distance betwixt any two stars contained in the Globe.

To know how one place beareth from another.

Propoſition. 5.



THough you may partly find out this by marking the direction of the lines, proceeding from the Mariners Compaſſe set downe in the Globe: yet in mine opinion it is readier to do it by applying the Flie described in my little treatiſe of vniuerſall Mappes, vnto the Globe by setting the Center thereof vpon the first place from whence you goe, and by drawing

drawing a thread through that place where to you would goe, in such order as is there taught, so you shall find Venice to beare from London South East and by East, and Ierusalem to beare from London East, South East, and two quarters more towards the South. But Gemma Frisius teacheth to know by the Globe how one place beareth from another thus, hauing set the Globe and also the Zenith of the quarter of altitude at such Latitude as the first place or region hath, from whence you would goe, bring that first place vnder the brazen Meridian, and there stay the Globe vntil you haue brought the quarter of altitude to the second place and the neither end of the quarter of altitude wil shew you vppon the Horizon amongst the winds, how the second place beareth from the first, so shall you finde Hispaniola to beare from Spaine right West, these be the chiefest propositions belonging to the vniuersall Map, wherewith the terrestriall Globe is couered, and therefore I will now set downe those that belong to the Sunne, which may be done as well by the one Globe as by the other, and first how to finde out the place of the Sunne.

How to find out by the Globe the Place of the Sunne, that is to say, the degree and minute of that signe wherein the Sun is euery day throughout the yeare.

Proposition. 6.

THough the surest way bee to finde it out by the Ephemerides, which sheweth the very minute, yet without hauing respect to the minute, you may finde it out by the Globe thus, seeke out the day of the moneth vpon the Horizon, and that will point you to the degree of the signe wherein the Sunne is that day: As for example, the 6. day of May pointeth right to the 25. degree of Taurus the Globe standing leuel, and your rule being rightly laide vpon the Horizon but during the leape yeare you must adde one degree more then the Horizon sheweth euery day from the beginning of the leape yeare throughout all that yeare.

How

How to rectifie the Index of the houre wheele for euery ſeuerall day throughout the yeare.

Propoſition.

HAuing placed ẏ Globe at your Latitude and alſo found out the degree of the Sunne as is before taught, bring that degree of the Sunne to the Brazen Meridian, & there ſtaying it with the one hande, turne with your other hande the Inder of the houre wheele to the higheſt part of the ſaid wheele marked with the number of 12. ſetting the point of the Inder iuſt with the ſtreeke of the wheele made to ſhew the houre of 12. or noonetide, and that will ſerue your turne for all that day, and thus muſt you doe euery day in which you haue to vſe the helpe of the ſaid houre-wheele for any purpoſe.

How to know euery day at what houre the Sunne riſeth or ſetteth.

Propoſition. 8.

HAuing ſet the Globe at your Latitude, & rectified the Inder of the houre-wheele by the 7. propoſition, turne the Globe to the Eaſt, ſo as the degree of the Sunne may touch the Horizon, and then the inder of the houre wheele will ſhewe you at what houre the Sunne riſeth, Againe, if you bring the ſaide degree of the Sunne vnto the Weſt part of the Horizon, the Inder of the houre-wheele will ſhew you at what houre he goeth downe. As for example, Anno 1590. ẏ third of June, the Sunne being in the 21. degree 33′ of Gemini. I bring the point to the very edge of the Horizon on the Eaſt part thereof, and there ſtaying

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ing it, the Inder of the houre whéle ſheweth that the Sunne riſeth 8′. before foure of the clocke in the morning: and the ſaid point of the Ecliptique being turned to the Weſt part of the Horizon, the Inder ſheweth that he ſetteth 8′. after 8. of the clocke at night.

How to know in what part of the Horizon the Sunne riſeth and ſetteth euery day,

Propoſition, 9.

SEeke the decrée of the Sunne in the Ecliptique line, and turne it to the Eaſt part of the Horizon, then you ſhall ſée whether it riſeth iuſt Eaſt or not, and whether it inclineth towards the South, or towards the North, and likewiſe by bringing the ſaid degrée to the Weſt part of the Horizon, you ſhall ſée in what part of the ſaid Horizon he goeth downe: As for example, in the laſt propoſition the Sunne being in the 21. degrée, 3′3. of Gemini, and brought to the Eaſt part of the Horizon, I find that the Sun did riſe diſtant from the Eaſt towards the North 38. degrées, 3′0. of the Horizon, which is three points and ſomewhat more of the Marriners Compaſſe from Eaſt, towardes the North, ſo as the Sunne riſeth Northeaſt and by Eaſt, and a little more Northward, and the ſaid place of the Sunne being brought to the Weſt part of the Horizon, I find that he ſetteth North Weſt ⅛ by Weſt and ſomewhat more Northward.

How

How to know the length of euery day and night throughout the yeare, as well by help of the houre wheele as by counting the degrees vpon the Horizon.

Proposition. 10.

FIrst you must know when the Sun riseth and setteth by the eight proposition, then looke how many houres the Inder doth go from the Sunne rising to the Sun setting, and that is the length of the day, which number if you take from 24. the night will appeare: as for example, knowing by the 8. proposition, that the Sunne being in the 21. degree, 3′3. of Gemini, riseth 8′. before 4. in the morning, and goeth downe 8′. after 8. of the clocke at night, I find by counting the houres which the Inder of the houre wheele hath run, that the length of the day is 16. houres & 1′6. which you may know also by counting the degrees vpon the Horizon from the place of the Sunnes rising, vnto the South point of the said Horizon, which you shall finde to be 128. degrees, which being doubled maketh 256. degrees, which if you diuide by 15. it will make 16. houres and 1′6. as before.

How to know by the Globe how much the Sun declineth euery day throughout the yeare from the Equinoctiall.

Proposition. 11.

HAuing found the place of the Sunne, bring the same to the Brazen Meridian, and by counting how many degrees are betwixt that place and the Equinoctiall, you shall know what declination the Sun hath that day: As for example, supposing the Sun that day you seeke to be in the first degree of Gemini, bring the said degree of the Ecliptique

cliptique to the brazen Meridian, and you shall find vpon the same Meridian the Sunne to be declined from the Equinoctiall Northward almost 20. degrées. Againe, supposing the Sunne to be in the first degrée of Aquarius, if you bring the said degrée of the Ecliptique vnto the Meridian, you shall finde the declination of the Sunne to be almost 20. degrées Southward.

How to know by the Globe the Meridian altitude of the Sun, that is to say, his height at noonetyde euery day throughout the yeare, & how far he is then distant from your Zenith.

Proposition. 12.

BRing the place of the Sunne that day you seke to the brazen Meridian, and staying it there, count vpon the said brazen Meridian, how many degrées are contained betwixt the place of the Sunne & the South point of the Horizon, and that is the Meridian Altitude of the Sunne for that day, which if you subtract from 90. the remainder will shew how many degrées he is distant that day at noontide from your Zenith: as for example, supposing the Sun to be that day you seke in the first degrée of Taurus, bring that degrée of the Ecliptique to the brazen Meridian, and stay it there vntill you haue counted how many degrées of the said Meridian are contained betwixt the place of the Sunne, and the South point of the Horizon, and you shall finde the number of degrées to be 50 which is the Meridian altitude of the Sunne for that day, which 50. degrées being taken out of 90. there remaineth 40. and so many degrées the Sunne is that day at noontide distant from your Zenith. The like order is to be obserued in seking to know the Meridian altitude of any Starre, or any other point in heauen.

How to know the altitude of the Sunne at any other houre of the day.

Proposition, 13.

HAuing rectified the Inder of the houre-whéele by the seuenth proposition, if the houre which you séeke be in the forenoone, turne the Globe so as the Inder of ỹ houre whéele may touch that houre of the forenoone, at which you desire to know the altitude of the Sun, & there stay the Globe, vntill you haue brought the quarter of altitude on the East side of the Globe vnto the place of the Sunne, so shall you find vpon the said quarter the altitude of the Sunne at that houre. And if you desire to know the altitude of the Sun at any houre in the afternoone, then turne the Globe so as the Inder of the houre whéele may touch the houre of the afternoone, and there stay the Globe vntill you haue brought the quarter of altitude on the West side of the Globe vnto ỹ place of the Sunne, & the said quarter will shew you the altitude of the Sunne at that houre. As for example, I would know how high the Sunne is at 8. of the clocke in the morning, the Sunne being in the first degrée of Taurus: here hauing rectified the Inder of the houre whéele, I turne the Globe so as the Inder of the houre whéele may lie vpon the 8. houre of the forenoone, and there I stay the Globe vntill I haue brought the quarter of altitude on the East side of the Globe vnto the place of the Sunne, whereby I find the altitude of the Sunne at that houre to be almost 28. degrées. Againe, if you will know how high the Sunne is being in the same degrée of the Ecliptique at 5. of the clocke in the afternoone, then turne the Inder of the houre whéele, so as it may touch that houre, and stay it there vntill you haue brought the quarter of altitude on the West side of the Globe vnto the place of the Sun, so shall you find the altitude of the Sunne to be at that houre 11. degrées.

How

How to know the houre of the day by the Globe.

Propoſition. 14.

This is to be done two manner of wayes, the firſt is thus, ſet the Globe in ſome open place whileſt the Sunne ſhineth, and you muſt ſee that it ſtand both leueil and alſo right North and South, as is taught in the firſt Propoſition, and that the Inder of the houre wheele bee rectified according to the degree of the ſigne wherein the Sun is that day by the ſeuenth Propoſition, that done, fixe a needle in the place of the Sunne, and turne the bodie of the Globe to and fro vntill the needle caſt no ſhadow at all, and there ſtaying the Globe, the Inder of the houre wheele will ſhewe you the houre of the day. But if you ſeeke the houre in the forenoone, remember to turne the Eaſt ſide of the Globe towardes the Sunne, if in the afternoone, then turne the Weſt ſide of the Globe towardes the Sunne. The ſecond way is thus, hauing rectified the Inder of the houre wheele, take the altitude of the Sunne with ſome Quadrant or Aſtrolabe, and hauing marked the ſame altitude vppon the quarter of altitude, applye it to the degree of the Sunne on the Eaſt ſide of the Globe if it be in the forenoone: but if it be in the afternoone applie the quarter of altitude to the degree of the Sunne on the weſt ſide of the Globe, and the Inder of the houre wheele will ſhew you the houre which you ſeeke. As for example, the 6. of June 1590. the Sunne being in the 24. degree, 24. of Gemini, I found by my Aſtrolabe the altitude of the Sunne to be 48. degrees, which I marked vppon the quarter of altitude, and becauſe I tooke the altitude of the Sunne in the forenoone, I brought the quarter of altitude marked with that degree to the place of the Sunne on the Eaſt ſide of the Globe, and there ſtaying the Globe I found that the Inder of the houre wheele did point to the ninth houre of the forenoone and ſomewhat paſt. The like is to bee done to know any houre of the afternoone, ſo as you forget not to apply the quarter of altitude vnto the place of the Sunne on the Weſt ſide of the Globe.

And by taking the altitude of any knowne Starre, and working in like manner as before, you ſhall knowe the houre of the night as ſhall bee taught hereafter whenwee come to treat of the Starres.

To know how much the vnequall houres otherwiſe called the planetarie houres doe differ from the Artificiall houres throughout the yeare, and how many minutes euery vnequall houre containeth.

Propoſition. 15.

FIrſt you muſt know by the 10. Propoſition the length of the day, that is to ſay, how many houres it is long, and reduce thoſe houres into minutes and diuide the product by 12. and the quotient, together with the remainder (if there be any left after the diuiſion) will ſhew you the quantitie of the vnequall houre of the day, that is to ſay, howe many minutes it containeth The like is to be done to know the vnequall houre of the night, for hauing the length of the artificiall night, worke as before, and you ſhall haue your deſire: As for example, knowing by the 10. propoſition the length of the day when the Sunne is in the 21. degree, 3′3. of Gemini to bee 1′6. houres 1′6. here by reducing thoſe houres into minutes, and by deuiding the product thereof by 12. you ſhall find the vnequall houre of the day to containe 81. minutes and $\frac{1}{10}$. of a minute or 20 ſeconds, which is more than one whole artificiall houre of the day by 21. minutes and 20. ſeconds. Againe, knowing the length of the artificiall night by the ſaide propoſition to be 7. houres, 44. minutes, if you do reduce the ſame into minutes, and deuide, by 12. you ſhal finde thereby the vnequall houre of the night to containe no more but 38. minutes, and 40. ſeconds, which is leſſe then the artificiall houre of the day by 21. minutes, and 40. ſeconds.

How

Item the moſt part of the Image of Bubulcus, hauing a club in his right hand, in whoſe left ſhoulder is a Starre of the fourth bigneſſe called Ceginus, and there is another of the fourth bigneſſe in his club, right againſt his face called Incalurus.

Item the foꝛe part of the little Beare called Vrſa minor, arctos and Cinoſura.

The Northerne Images contained in the ninth ſpace.

FIrſt ꝑ vpper part of Serpentarius, otherwiſe called Ophiuchos and alangue in the Crowne of whoſe head is a ſtar of the third bigneſſe called iras alangue.

Item the whole Image of Hercules with the Lyons ſkin hanging on his left arme, otherwiſe Engonaſi, algethi, Neſſus, and ignotum idolum (his right hand holding the club, & his right leg excepted) in whoſe head is a ſtarre of the third bigneſſe, called Ras Algethi, and this Image lyeth groueling with his heeles towards the Noꝛth pole, and his head towardes the Equinoctiall, which meeteth almoſt with the heade of Serpentarius.

Item the head of the Dꝛagon called Draco ꝑ Aben, in whoſe head is a Starre of the third bignes called Ras Aben.

Item a part of his tayle contayning 6. ſtarres.

Item the hinder part of the little Beare, contayning two ſtars.

The Northerne Images contained in the tenth ſpace.

FIrſt, the vpper part of Antinous, hauing at each elboe a ſtar of the third bigneſſe.

Item the laſt end of the Serpents tayle, in the tip whereof is a ſtarre of the fourth bignes.

Item the whole Image of the Eagle called Aquila, Vultur volans, Actos and Alcair.

Item the whole Image of the Shaft called Sagitta, Telum and Hoiſtos.

Item the whole Image of the Harpe called Lira and Alohore that is to ſay, Vultur cadens, and Chelis, in the vpper part whereof towards the left hand is a faire ſtarre of the ſecond bigneſſe called

led Fidicula, lira, Alangue, vega, and Brineck.

Item the head, necke, and left wing of the ſwan, called Auis, Cignus, Olor, Hornis, Adigege, and of ſome Gallina.

Item the necke, body and foꝛe part of the Dꝛagon contayning 11. Starres.

Item part of the little Beares taile, containing one Starre next to his rumpe of the fourth bignes.

The Northerne Images contained in the 11. ſpace.

FIrſt, the Crowne of Aquarius his head, contayning one Star of the fift bignes.

Item the little hoꝛſe called Equus and Hippos, whoſe necke is incloſed with a cloud, and in his head are foure little ſtarres.

Item the head and two foꝛe feet of the winged hoꝛſe called Pegaſus, on whoſe right noſtrell is a ſtarre of the third bignes called Eniph Alpharaz.

Item the Dolphin called Delphinus, contayning ten Starres whereof one is of the third bignes.

Item the body, legs, and the right wing of the ſwan, which lyeth on her backe with her bellie vpward, in whoſe body towards the taile, is a faire Starre of the ſeconde bignes called Deneb Adigege, and Arided.

Item the right arme and right leg of Cepheus, on whoſe right ſhoulder is a ſtar called Alderaimin.

Item part of the little Beares taile contayning the middle ſtarre of his tayle.

The Northerne Images contayned in the 12. ſpace.

FIrſt, the moſt part of the foꝛmer fiſh of the ſigne Piſcis toge-ther with part of her band.

Item the necke, body and wing of Pegaſus, otherwiſe called Equus Gorgoneus, and Alpharaz, riſing out of a cloud, in which cloud is the head of Andromeda, hauing on the right ſide there-of a faire ſtarre of the ſecond bignes, and in the right wing of Pe-gaſus is a ſtarre of the ſecond bignes called Marcab Alpharaz,

and

and on his right ſhoulder another Starre of the ſecond bigneſſe called Scheat Alpharaz.

Item the right arme and hand of Andromeda holding part of her chaine, in the ring whereof is a Star of the fourth bigneſſe.

Item the right arme of Cepheus.

Item the tip of the little Beares taile, in which is the Noyth Starre called Alrucuba of the third bigneſſe.

The names of the images contained in the celeſtiall globe betwixt the Equinoctiall and the South Pole together with ſo many ſtars as are named in that part of the globe, beginning as I did before in deſcribing the Northerne Images at the Vernall Equinoctiall point, and ſo proceede from ſpace to ſpace contained betwixt euery two Meridians towardes the right hand.

The Southerne Images contained in the firſt ſpace, beginning at the Vernall Equinoctiall point

FIrſt the moſt part of the Whale called Cetus, Piſtrix, and Balena (his head and foze part of his belly excepted) in the mid body whereof towards the backe, is a ſtarre of the fourth bigneſſe called Baten Kaetos, and in the lower part of his taile is another ſtarre of the third bigneſſe, called Deneb Kaitos.

The Southerne Images contained in the ſecond ſpace.

THe foze part of the Whales belly and his ghilles, containing fiue Starres

Item the moſt part of the floud Eridanus, called of ſome Nilus, and in Greeke Potamos Eridanos, containing 22. ſtarres, whereof one is called Angetenar, which is about the middeſt of the Floud nigh vnto the Whales belly, and there is in the very ende of the Floud another ſtarre of the firſt bigneſſe, called Acarnar.

The Southerne Images contained in the third ſpace.

Firſt

FIrst, the nether part of Orion or Alguze from the middle of his backe downeward, in whose girdle are three faire Starres, whereof the middle starre is of the second bignesse called Orion or Alguze.

Item another part of the floude Eridanus, which semeth to come from the left foote of Orion, which starre in the left foote is called Algebar, Rigel, Alguze.

Item the whole Image of the Hare, called Lepus and Lagos containing 12. little starres.

Item the rest of Eridanus containing foure Starres, whereof there is one called Beemum of the fift bignesse.

The Southerne Images contained in the fourth space.

FIrst, the whole Image of the great Dog called Canis maior, and Syrios in whose mouth is a starre of the first bignes called Asceher and Alhabor.

Item the forepart of the great ship Argos, with her two Dares hauing a scutchen with 4. Starres, the greatest whereof being of the third bignes is called Markeb, and vnder the vpper hatches in the forepart of the ship is a Starre of the fift bignesse called Alphard, and in the left Dare towards the South pole, is a faire starre of the first bignesse, called Canopus and Suhel.

The Southerne Images contained in the fift space.

FIrst, the mid part of the Serpent called Hydrus and Asuia, in the which is a faire star of the secõd bignes called Alphard.

Item the hinder part, mast and toppe of the ship Argos, which semeth to come out of a cloud, containing diuers Starres of diuers bignes without name.

The Southerne Images contained in the sixt space.

ITem another part of Hydrus whereupon standeth the Image of the cuppe or boule called Crater, vas and patera, and also the Crowes head.

Item

Item the hinder part of Centaurus, in euery part whereof are diuers Starres without name.

The Southerne Images contained in the seuenth space.

FIrst the left wing of the signe Virgo and her left hand, holding an eare of wheat, whereon is a Starre of the first bignes, called Spica Virginis, Stachis, Acimon, Alacel, and Azimech.

Item the Crowe called Coruus and Corax, his head and necke excepted, in whose left wing is a starre of the fourth bignesse called Algorab.

Item the rest of Hydrus, whereon the Crow standeth, containing three starres without name.

Item the rest of Centaurus or Chiron with his horsselaffe trimmed with boughes, his right hand and right foote excepted.

The Southerne Images contained in the eight space.

THe whole Image of Libra, the ring onely excepted.

Item the fore part of Scorpio, whose fore cleas do lie vpon the two ballances, that is to say, his right clea vpon the North ballance, and his left clea vpon the South ballance, hauing vpon ech clea a starre of the second bignes.

Item part of the Serpent called Anguis or Ophis, hauing one Starre of the fourth bignes.

Item the left hand of Serpentarius, holding part of the Serpent, vpon which hand are two starres of the third bignesse called Yedd.

Item vpon the head of Scorpio are 3. stars of the third bignes, standing all in a row and diuers others as well vpon his backe as vpon his left little clea without name.

Item the whole Wolfe called Fera, Lupus and Therion.

Item the right hand of Centaurus holding the said Wolfe by the belly in both which are diuers starres without name.

Item the right foote of Centaurus, in which is a faire starre of the first bignes, and is called by the name of Centaurus.

The Southerne Images contained in the ninth ſpace.

FIrſt, the nether part of Serpentarius, that is to ſay, from his mid backe downward, hauing the ſerpent winding betwixt his legs and aboue his right arme, in both which are diuers Starres without name.

Item the hinder part of Scorpio, from his mid body to the outermoſt end of his tayle, who hath diuers names, as Scorpius Nepa, Alatrab, in the midſt of whoſe body is a faire Starre of the firſt bigneſſe called cor Scorpionis, Antares, and chalb Alatrab, and in the tip of his tayle are two Starres of the third bigneſſe, called Alaſcha and ſcomlec Alatrab.

Item the moſt part of the Bowe with the head of the ſhaft of Sagittarius and his right foote, in all which parts are diuers ſtars without names.

Item the Altar with the flame and ſmoke called Ara, thuribulum, lar, ſacrarium, thimiaterion.

The Southerne Images contained in the tenth ſpace.

THe lower part of Antinous from the breaſt downward kneeling vpon an Altar containing foure Starres without name.

Item the forepart of Capricornus his head.

Item the Image of Sagittarius, otherwiſe called Crotus and toxeuter (his bow, the end of his arrow, & his right foote excepted) hauing diuers Starres without name.

Item the Southerne Crowne, called Corona Auſtralis, and Notios ſtephanos, and of Aratus, it is called Dinotos Cyclos, that is to ſay the Southerne Circle, which Crowne is placed betwixt the two fore legs of Sagittarius, and in the ſaid Crowne are diuers ſtarres, amongſt which there is one of the ſecond bigneſſe touching the left knee of Sagittarius called Corona Auſtralis, who alſo hath on his left foote another Starre of the ſecond bigneſſe without name.

The Southerne Images contained in the 11. ſpace.

The

The fore part of Aquarius otherwise called Ganimedes & Hydrochos, holding a handkercher in his left hand, wherein are three Starrs, and hath diuers Starrs in his body without name.

Item the whole Image of Capricornus, otherwise called Pan-Aigoceros, and Algedi, the fore part of his head onely excepted in whose taple is a starre of the fourth bignes called Deneb Aldegi.

Item the hinder part of the Southerne fish hauing diuers starres without name.

The Southerne Images contained in the twelfth space

First Aquarius his right hande holding the water-pot called Vrna and Chalpe, out of the which he poureth the water down into the mouth of the Southerne fish, which water is called Aqua and hydor in which are diuers starres without name.

Item the lower bellie part of the former fish of the signe Piscis wherein are two starres without name.

Item both the thighes and legges of Aquarius, vpon the calfe of whose right leg is a starre of the third bignesse called Scheat Aquarii, and Crus Aquarii.

Item the head of the Southerne fish called Piscis Meridionalis, and Athis notios, in whose mouth is a faire star of the first bignesse, called Fomahant.

But you haue to vnderstand that besides the 15. Southerne Images before mentioned, there are lately found out by the Portugales and others that haue sailed in the East and West Indies 4. other Images towards the south Pole, as the crosse or Croster the south triangle, Noahs doue or Pigion, & another Image made like a Philosopher called Polophilax, all which are set downe in the celestiall Globe, lately set forth, first at the great charges of M. Sanders, and now at the like charges of M. Molinax of Lamberth of whome I lately bought both the Globes, that is, the terrestriall and celestiall, and I wish that the longitude, latitude and declination of euery starre contained in the saide 4. Images were truely set downe, for Plancius maketh some doubt thereof. Not-

withstanding if you be desirous to know the longitude, latitude, and declination of the saide Starres by helpe of the foresaide great Globe, then you must worke as I doe shewe you hereafter in seeking for any Starre contained in Mercator his Globe, so shall you haue your desire.

Moreouer, to most of the Stars described in the Globe are annexed the Characters of some of the 7. Planets, to shew the nature and qualitie of the starres and some starres are also marked with some one letter or other, the more readily to finde out thereby the foresaide Characters. As for example, to Cor Leonis are annexed the Characters of Iupiter and Venus, and vnder the said star is set the letter. m. to shew the Characters which are not alwaies set hard by the starre, but sometime a good distance off, for where the characters are set nigh vnto the starre, there needeth no letter, as in the starre called Spica Virginis, whereunto are annexed the characters of Mars & Venus, without any letter to signifie the same, and where diuers starres be of one selfe qualitie, they are seuerally marked with letters of one selfe same shape, as about the Starre Spica Virginis you shall finde diuers little Starres, each one marked with the letter h. signifying their nature to be all one, that is, to participate of Mars and Venus, to whose Characters is also ioyned the letter h. signifying that they bee of that nature and quality.

The Characters are these here following set ouer euery Planets head.

♄	♃	♂	☉	♀	☿	☽
Saturne.	Iupiter.	Mars.	Sol.	Venus.	Mercury.	Luna.

The nature of euery one of the Planets here followeth.

SAturne is colde and drie, Iupiter is temperatly hotte and moyst. Mars is extreamely hotte and drie. Sol hotte and somewhat drie. Venus is temperately colde and moyst, Mercurie is of changeable nature, and ꝟiant to the nature, bee it good

good or bad of euery other Planet or fixed Starre whereto it is ioyned. Luna is cold and moiſt.

Beſides the Images and ſtarres both Northerne & Southerne aboue mentioned, there is alſo ſet downe in the Celeſtiall Globe a certaine impreſſion called in Greeke Galaxia, that is to ſay, the milke white way, the deſcription whereof here followeth.

A briefe deſcription of the milke white way, called in Greeke *Galaxia*, and in Latine *Via lactea*.

THis way as Garceus writeth, proceedeth from the ſigne Gemini, and ſo paſſeth through the legs and ioynes of Erichthonius, & from thence through the right ſide of Perſeus, and then through the whole Image almoſt of Caſsiopeia, and from thence through the left wing of the Swan called Auis, Gallina and Cignus, and from thence through the Image called in Latine Telum, in Engliſh a Dart, ſhaft, or quarrell. and from thence through the flying Eagle called in Latine Vultur volans, and from thence through the greateſt part of Sagittarius his bow, and from thence through the Alter called Ara and Thuribulum, and from thence through the legges of Centaurus, and ſo to the ſhip called Argos, from whence riſing againe, & paſſing through part of the great Dog called Canis maior, it returneth againe to Gemini.

Thus hauing deſcribed vnto you all the 48. Images, and ſhewed the names of as many Starres as are named in the Globe, and alſo the milke white way, I mind now to proceede to the propoſitions belonging to the fixed Starres deſcribed in the Globe, as followeth.

How to finde out in Heauen any vnknowne Starre deſcribed in the Globe two manner of waies, that is, either by the

helpe of ſome knowne ſtarre or elſe by knowing the true houre of the night.

Propoſition. 20.

THe firſt and ſureſt way is thus, take with your Quadrant or Aſtrolabe the altitude of the knowne Starre, marking therewith in what part of the heauen the ſame is ſituated Eaſt or Weſt, North or South, and then hauing ſet your Globe right North & South, & at the true latitude of the place where you are, bring ỳ quarter of altitude to the ſaid Starre, and therewith turne the Globe vntill you ſée that the ſaid Star hath the like place and the like altitude in the Globe that it had in heauen, then képing the Globe ſtill at that ſtay, ſéeke in the Globe the ſtarre that you would finde out in the firmament, and marke well in what part of the Globe it is ſituated, and how it beareth from the known Star, either Eaſt, Weſt, North or South, and bring the quarter of altitude to that Starre, that you may know the altitude thereof by helpe of the ſaid quarter, which altitude once taken, turne your eyes towards that part of the firmament, & hauing placed the Diopter of your Aſtrolabe at that altitude, loke what ſtar in that part of the firmament doth anſwere to ſuch altitude, and that is the Starre which you ſéeke, whoſe name for the moſt part is ſet downe in the Globe. The ſecond way is thus, hauing learned the true houre of the night by ſome clocke or watch, bring the degree of the Sun vnto the brazen Meridian, and holding it there, ſet the Inder of the houre wheele iuſt at the 12. houre, that done, turne the body of the Globe to or fro vntil the Inder of ỳ houre wheele fall iuſt vpon the houre which you ſéeke, and képing the Globe at that ſtay, ſéeke out the vnknowne ſtarre in the Globe, and conſider how it beareth from you in the Globe either Eaſt, Weſt, North or South, then bring the quarter of altitude to the Star, that you may know thereby what altitude it hath in the Globe, which once found, and hauing ſet the Diopter of your Aſtrolabe at that altitude, turn your eye towards

that

that part of the firmament whereunto the place of the ſtarre found in the Globe directeth you, and that Star which anſwereth to that altitude is the ſtar which you ſeeke. But this way is not ſo ſure as the other way firſt taught, vnleſſe you know the true houre indeed,

How to know by the Globe the Meridian altitude which is the higheſt altitude of any ſtarre, and alſo how high or lowe he is at any other time.

Propoſition, 21.

HAuing ſet ỹ Globe at your latitude, bring the ſtarre to the brazen Meridian, and there ſtaying it, number vpon the brazen Meridian the degrées contained betwixt the ſaid ſtarre and the South or North point of the Horizon, according as the ſtarre is ſituated either Northward or Southward, for ſo in the Latitude 52. you ſhall finde the Meridian or higheſt altitude of the Starre Arcturus or Bubulcus to be 6. degrees. But if you would know his altitude at any other time, then you muſt rectifie the Index of the houre whéele by the 7. propoſition, and hauing ſet the Index at the houre whereſo you ſéeke, ſtay the Globe there, vntill you haue brought the quarter of Altitude vnto the ſtarre, and that will ſhew the altitude of the ſtarre at that houre if it be aboue the Horizon.

How to know by the Globe what ſtars are aboue the Horizon at any time of the day or night.

Propoſition. 22.

OF ſtarres according to diuers Latitudes ſome are alwaies aboue the Horizon, and ſome are alwaies vnder the Horizon, and ſome doe both riſe & ſet, if you would knowe what ſtarres bee aboue the Horizon in the daye time, then hauing rectified the Index of the houre

wheele by the ſeuenth propoſition, take the altitude of the Sunne with your Aſtrolabe or quadrant, and therewith conſider whether the Sunne bee in the Eaſt part, or in the Weſt part of the firmament. Then bring the quarter of altitude on the Eaſt or Weſt ſide of the Globe according as you ſaw the Sunne at that preſent to be in the firmament, and make the degree of altitude, marked in the quarter of altitude, to meete euen with the degree of the Ecliptique line wherein the Sunne is that day, and there ſtaying the Globe, you ſhall ſee all the ſtarres that bee aboue the Horizon at that preſent, as wel on the Eaſt ſide as on the Weſt ſide of the Globe, and the Inder will ſhew you at what houre you tooke the foreſaid altitude. But if it be in the night ſeaſon, and that the ſtarres doe appeare, take with your Aſtrolabe the altitude of ſome knowne ſtarre, and by doing as is before taught, you ſhall haue your deſire. But you muſt not forget firſt of all to rectifie the Inder of the houre wheele by the ſeuenth propoſition.

How to know by the Globe at what time any ſtarre ryſeth aboue the Horizon, mounteth to the higheſt, and ſetteth, and with what degree of the Ecliptique hee ryſeth, mounteth, and ſetteth: and alſo in what part of the Horizon he riſeth and ſetteth.

Propoſition. 23.



Auing rectified the Inder of the houre-wheele by the ſeuenth propoſition, bring the ſtarre to the Eaſt part of the Horizon, ſo as it may touch the edge thereof, & the Inder of the houre wheele will ſhewe at what houre he riſeth, & by looking at that inſtant to the Ecliptique line you ſhall ſee what degree of the Ecliptique ariſeth thē with him. That done, bring the ſaid Starre to the brazen Meridian, & the Inder of the houre wheele wil ſhew at what houre hee is at the higheſt, and there ſtaying the Globe, marke what degree of the Ecliptique line doth fall right vnder the brazen

brazen Meridian at that instant, for that degree is said to accompanie him when he is at his highest. Then bring the said starre to the West part of the Horizon, and you shal find by the Index of the houre wheele at what houre he setteth, & what degree of the Ecliptique doth accompanie him at his setting. As for example, I would know the sixteenth day of June 1590. the Sunne being in the fourth degree of Cancer, when Arcturus otherwise called Bubulcus and Lanceator doth rise, mounteth to the highest, and setteth, here hauing rectified the Index of the houre wheele by the seuenth Proposition, I bring the saide Starre to the East parte and very edge of the Horizon, and I finde that he riseth a little before twelue of the clocke at noone, and that the 28. degree and 30. of Virgo, riseth with him, and by looking amongst the winds vpon the Horizon right against the place of his rising, I find that he riseth Northeast and by East. Secondly by bringing the said star to the brazen Meridian, the Index of the houre wheele sheweth that hee is at his highest halfe an houre after seuen of the clocke at night, and is then plaine south, and that the 29. of Libra, doeth then accompanie him. Thirdly by bringing the said starre to the West part of the Horizon, the Index of of the houre wheele sheweth that he setteth or goeth downe a quarter of an houre before foure in the morning, and that the fourth degre of Capricornus doth accompanie him at his setting: and by looking there vpon the Horizon, I finde amongst the winds that the said star setteth Northwest and by West.

How to know in what part of the firmament, any star is and how many degrees it is distant frō the Meridian at any houre, and being right vnder the Meridian to know how far it is distant from your Zenith.

Proposition. 24.

HAuing rectified the Index of the houre-wheele by the seuenth Proposition, turne the Globe vntill the Index touch the houre wherein you seeke. And staying the Globe there, bring the quarter of Altitude to the Starre bee it on the East or West side of the

Globe

Globe, and the nether end of the said quarter will shew vppon the Horizon among the winds, in what part of the firmament the star is: now if you would know how farre that starre is distant from the Meridian doe thus: looke what degree of the Equator is at that instant vnder the Meridian, and there make a marke, and then turne the Globe vntill you haue brought the said starre vnder the brazen Meridian, and marke what degree of the Equinoctiall the said Meridian cutteth at that instant, that done, count the degrees contained betwixt the two markes vpon the Equinoctiall, for so many degrees is the starre distant at that time from the Meridian either towards the East or West, and by allowing 15. degrees to an houre, and 4'. to a degree, you shall know in what time the said starre hath to approch to the Meridian, or how much he is past the Meridian, and hauing brought the said starre right vnder the Meridian, you shall knowe how farre it is distant from your Zenith, by counting the degrees that are contained in the Meridian betwixt the said starre and your Zenith. As for example, the first of October 1591. (the Sunne being then in the 22. of Libra) I find the star Cor Leonis at three of the clocke in the after noone to be West, Northwest, and there staying the Globe, I see that the Meridian cutteth the Equinoctiall at the 246. degree, whereas I make a marke, that done, I bring the Starre Cor Leonis to the said Meridian, at which instant the Meridian cutteth the Equinoctiall in the 146. degree, which being taken out of 246. there remaineth 100. degrees, which is his distance from the Meridian, which being deuided by 15. I finde in the quotient 6. houres and 40'. for so much as hee is past the Meridian towardes the West, and by bringing the foresaide Starre to the Meridian, I finde him to be distant from our Zenith 39. degrees, and 30. minutes.

How to finde the houre of the night by the Globe.

Proposition. 25.

Hauing

HAuing ſet the Globe at your Latitude, rectifie the Index at the heure-whéle by the ſeuenth Propoſition, then hauing taken the Altitude of ſome ſtarre that you know, and is in the Globe with your Aſtrolabe or Quadrant, bring the quarter of Altitude vnto the ſtarre, be it in the Eaſt or Weſt according as you found the ſtar to be in the firmament, not leauing to turne the Globe, vntill you haue made the ſtarre to haue the like Altitude in the Globe vpon the quarter of Altitude, and alſo the like ſituation that you found it to haue in the firmament by your Aſtrolabe or Quadrant, and ſtaying the Globe there, the Index of the houre-whéle will ſhew the houre: As for example, in the yeare 1590. the firſt of Januarie the Sunne being in the 22. of Aquarius, I hauing with my Aſtrolabe found that the ſtarre called Canis maior, that is to ſay the greater dogge, was eleuated aboue the Horizon in the Eaſt part of the firmament, 20. degrees, I brought the quarter of Altitude to the Eaſt ſide of the Globe, not leauing to turne the Globe vntill I had made the ſtar to méte euen with the 20. degrée of the quarter of Altitude, and there ſtaying the Globe, I found by the Index of the hourewhéle that it was 8. of the clocke at night, and a quarter paſt.

How to know the verticall ſtarres in euery Latitude.

Propoſition. 26.

THe Globe and the Brazen Zenith being ſet according to the Latitude of ỳ place where you are, turne the Globe from Eaſt to Weſt, and as many Starres as paſſe right vnder your Zenith are ſaid to be verticall as in the Latitude 52. you ſhall ſée the taile of the great Beare, the head of Perſeus and diuers others to paſſe through your Zenith in turning the Globe from Eaſt to Weſt.

How

How to know the true place of any Starre, that is to ſay, in what ſigne and in what degree thereof any Starre is.

Propoſition. 27.

HAuing faſtned the ſemi-Circle of Longitude and Latitude vpon the two poles of the Zodiaque, the North pole whereof is in the Circle Arctique not far from the right clawe of the Dragon, and the South pole thereof is in the Circle Antarctique right oppoſite to the other then bring the ſaid ſemi-Circle to the ſtarre, whoſe place you ſeeke, and marke therewith what point of the Ecliptique the ſaid ſemi-circle cutteth, and that is the place of the ſtarre. As for example, by bringing the ſaid ſemi-Circle to the ſtarre called Hircus, that is to ſay, the Goate, I finde it to be in the 15. degrés 30. minutes of Gemini, and that is his place.

How to find the Longitude of any ſtarre by the Globe.

Propoſition 28.

IHaue tolde you in my Spheare, that the Longitude of any ſtarre is that arch or portion of the Ecliptique line, which is contained betwixt the firſt point of Aries, and that Circle which paſſeth through the Poles of the Zodiaque, and alſo through the body of the ſtarre, which Circle, the ſemi-Circle of Longitude and Latitude here repreſenteth: and by making the ſaid ſemi-Circle to paſſe through the ſtarre called Hircus before mentioned, I finde that the number of degrées of the Ecliptique, contained betwixt the ſaid Circle and the firſt point of Aries to be 75. degrées & 30. which is the Longitude

gitude of the ſaide Starre, and thereby maketh his place to be in the 15. degree 30. of Gemini, as before is ſet downe in the laſt Propoſition.

How to finde out the Latitude of any ſtarre.

Propoſition. 29.

I Told you alſo in my Spheare, that the Latitude is none other thing, but the diſtance of any ſtarre from the Ecliptique line either towards the North or South pole of the Zodiaque, which diſtance the ſemi-Circle of Longitude and Latitude made to paſſe through the body of the ſtarre, and cutting the Ecliptique line doth alwaies wew, as in the former example, in making the foreſaide ſemi-Circle to paſſe through the foreſaid Starre called Arcus, I finde by counting the degrees of the ſaid ſemi-circle contained betwixt the Ecliptique line and the body of the ſtar, that the Latitude of that Starre is 22. degrees and 30. minutes towards the North, likewiſe by bringing the ſaid ſemi-Circle to the ſtarre which is in the right ſhoulder of Orion called bed Alguze I finde his Latitude to be 17. degrees towards the South.

How to finde out by the Globe, the declination of any ſtarre.

Propoſition. 30.

THe declination is none other thing but the diſtance of any ſtar from the Equinoctiall either towardes the North pole or South pole of the worlde, which is to bee founde thus: Firſt hauing brought the ſtarre right vnder the brazen Meridian, and there ſtaying the Globe, count the degrees of the ſaid Meridian contained betwixt the ſaid ſtarre

and

and the Equinoctiall point or streeke of the saide Meridian, & that shall be the declination of the starre: As for example, bring the star Hircus vnto the Meridian, and you shall find the declination thereof to bee 45. degrees towardes the North pole of the world, and that the starre which is in the foote of the Hare called Lepus, hath of South declination 23. degrees.

How to know the magnitude or greatnes of any star, & his nature and qualitie by the Globe, and also the right ascention of the Arque of the Ecliptique, which accompanieth the right ascention of any star.

Proposition. 31.

MErcator describeth the six magnitudes of ỹ Stars by making the six figures or shapes of the starres placed not far from ỹ head of the great Beare, whereof the first and greatest hath 16 points or beames, the seconde eight, the third six, the fourth fiue, the fift fire, which indeede by that account would be but foure: and the sixth hath fiue, which would haue but 3. but in mine opinion it had beene better to haue made the first magnitude with ten points, the second with nine, the third with eight, the fourth with seuen, the fift with sire, and the sixt with fiue: so should the magnitude of euery starre described in the Globe haue beene the more easily knowne. But to the intent that you might exercise your selfe in finding out by the Globe, the place, Longitude, Latitude, and declination of any Starre that is described in the Globe, I haue thought good to adde hereunto the Table of Garceus, shewing not onely the Longitude, Latitude, and declination of the most notable Starres that are both Northward and Southwarde, but also the right ascention, magnitude or bignes, the quality and nature of euerie such Starre and also the Arch of the Ecliptique line, which accompanieth the right ascention of euerie Starre, which Table

though

though by the ſaid Garceus was calculated out of the Aſtronomicall Tables for the yeare of our Lord 1564. and not by the Globe, yet for your better exerciſe in matters of the Globe I thought good to ſet downe ſuch Longitude, Latitude, declination, magnitude, and right aſcention, and all other things contained in the ſaid Table, according as they are to be found out by the Celeſtiall Globe of Mercator, and not calculated by any of the Aſtronomicall Tables.

Though the Longitudes and declinations of the fixed ſtarres ſet downe in this Table to ſerue Mercator his Globe, doe not altogether agree with the great Celeſtiall Globe, lately ſet forth by Maſter Sanderſon and by Maſter Molinaxe, by reaſon that the Longitudes and declinations of the ſaid ſtarres are more lately calculated, that is to ſay, for the yeare of our Lord, 1592. yet it will ſerue to ſhew you the way how to exerciſe your ſelfe in the ſaid Globe, and thereby you may correct this Table, & make it to agree in all points with the new great Globe, whereby you ſhall reape more pleaſure then griefe or paine. For I had this Table (as I haue ſaid before) out of Garceus, and did here ſet it downe more for your exerciſe, and to acquaint you with the fixed Starres that are deſcribed in the Celeſtiall Globe, then for any other purpoſe.

The vſe of the Table next enſuing.



This Table is deuided into eight collums. The firſt whereof on the left hand, containeth the names of the Starres, the ſecond the degrees and minutes of Longitude, together with the Characters of the 12. ſignes: the third the degrees and minutes of Latitude both Northerne and Southerne, the North Latitude being marked with the letter N. and the South Latitude with the letter S. the fourth containeth the degrees and minutes of declination both Northerne and Southerne, marked with the letters N. and S. as before. The

fift

firſt ſheweth the magnitude or greatneſſe of the Starre, whether it be of the firſt, ſecond or third bigneſſe, &c. The ſixth containeth the degrées and minutes of the right aſcention of the foreſaid fixed ſtarres. The ſeuenth containeth the Characters of the Planetes, ſignifying the nature and qualitie of the ſtarres. The eight containeth the degrées and minutes of the right aſcention of the Ecliptique line and the ſignes of the Zodiaque

Here followeth the Table.

The names of the ſtarres.	The Longitude & place.		The ſignes.	The Latitude		North & South.
The firſt ſtarre of the Ramme his horne.	27	40	♈	7	40	Nor.
The right ſhoulder of Cepheus.	8	0	♈	69	0	Nor.
The laſt ſtarre of Eridanus.	22	30	♈	53	30	Sou.
The ſhoulder of Andromeda.	16	20	♈	24	30	Nor.
The girdle of Andromeda.	24	50	♈	26	30	Nor.
The right ſide of Perſeus.	25	0	♉	30	0	Nor.
The head Algol or Meduza.	20	40	♉	23	0	Nor.
The South ſtarre of Pleiades.	23	29	♉	4	20	Nor.
The North ſtarre of Pleiades.	23	10	♉	5	0	Nor.
The Buls eye.	2	50	♊	5	0	Sou.
The right ſhoulder of Orion.	23	0	♊	17	0	Sou.
The left ſhoulder of Orion.	12	0	♊	17	0	Sou.
The right ſhoulder of Auriga.	24	0	♊	20	0	Nor.
The Goate or Hircus.	16	0	♊	22	30	Nor.
The former of the Kidds.	13	0	♊	18	0	Nor.
The latter of the Kidds.	13	30	♊	18	0	Nor.
The left noſe of Orion.	10	10	♊	31	30	Sou.
The tayle of the little ſtarre	21	10	♊	66	0	Nor.
The middle ſtarre of Orions girdle.	18	0	♊	24	30	Sou.
Canopus in the ſhippe Argo.	8	30	♋	75	0	Sou.
The great Dogge.	9	0	♋	39	10	Sou.
The little Dogge.	20	30	♋	16	0	Sou.
The former head of Gemini	14	20	♋	9	40	Nor.
The following head of Gemini	17	40	♋	6	30	Nor.
The North Aſellus.	1	30	♌	3	0	Nor.
The South Aſellus in Cancer	2	20	♌	0	10	Sou.
Præſepe the Manger in Cancer.	1	20	♌	0	40	Nor.
The ſhoulder of the great Beare	11	40	♌	49	0	Nor.
The bright ſtarre of Hydra.	21	0	♌	20	30	Sou.
The Lyons heart.	23	30	♌	0	10	Nor.
The Lyons backe.	23	10	♌	8	30	Nor.
The Lyons tayle	15	30	♍	12	0	Nor.
The middle ſtarre of the great Beares tayle.	9	50	♍	56	0	Nor.
The right wing of Virgo.	3	10	♎	15	10	Nor.

Declination.	No, & South	Magnitude or greatnes	The right ascēsiō Deer. Min.	The nature of the stars shewes by the characth of the planets.	The right ascention of the arch Ecliptique accompaning the star.	The characts of the signes
17 20	Nor.	3.	23. 0	♂ ♄	25 0	♈
61 0	Nor.	3	317 15	♄ ♃	15 0	♒
41 0	Sou.	1	43 30	♃ ♀	15 50	♉
28 26	Nor.	3	5 0	♀	5 0	♈
33 0	Nor.	3	12 10	♀	13 0	♈
48 0	Nor.	2	43 0	♄ ♃	15 29	♉
39 30	Nor.	2	40 20	♄ ♃	13 0	♉
22 0	Nor.	5	50 18	♂ ☽	23 10	♉
23 10	Nor.	5	50 0	♂ ☽	22 20	♉
15 30	Nor.	1	63 0	♂	4 20	♊
6 20	Nor.	1	83 20	♂ ☿	23 50	♊
4 40	Nor.	2	72 0	♂ ☿	13 0	♊
43 0	Nor.	2	82 82	♂ ☿	22 50	♊
45 0	Nor.	1	71 30	♂ ☿	13 0	♊
40 0	Nor.	4	68 50	♂ ☿	10 28	♊
39 40	Nor.	4	69 0	♂ ♀	11 0	♊
9 0	Sou.	1	73 0	♃ ♄	14 20	♊
86 0	Nor.	3	74 30	♄ ♀	4 30	♈
1 50	Sou.	2	79 45	♃ ♄	20 20	♊
52 0	Sou.	1	94 24	♄ ♅	3 30	♋
16 0	Sou.	1	97 0	♂ ♃	6 30	♋
6 10	Nor.	1	109 30	♂	18 0	♋
32 0	Nor.	2	106 47	♀	15 28	♋
28 30	Nor.	2	110 5	♂	18 20	♋
22 30	Nor.	4	124 0	♂ ☉	1 40	♌
19 20	Nor.	4	124 50	♂ ☽	2 0	♌
20 0	Nor.	neb	124 0	♂ ☽	1 30	♌
62 30	Nor.	2	161 0	♂	9 30	♍
5 0	Sou.	2	137 0	♄ ♂	14 30	♌
13 30	Nor.	1	145 93	♃ ♂	23 30	♌
21 40	Nor.	2	148 40	♄	26 0	♌
16 20	Nor.	1	171 10	♄ ♀	20 30	♍
56 55	Nor.	2	196 0	♂	17 0	♎
12 30	Nor	3	189 0	♄ ♅	9 40	♎

The names of the ſtarres.	The Longi-tude & place.		The ſignes.	The Latitude		North & South.
The left ſhoulder of Bubulcus.	10	0	♎	49	30	Nor.
The ravens bill.	6	30	♎	21	40	Sou.
Arcturus the great ſtarre betwixt Bubulcus his legs	18	0	♎	32	0	Nor.
Spica virginis	17	40	♎	2	0	Sou.
The middle ſtarre in the front of Scorpio	26	40	♏	1	30	Sou.
The South ballance of Libra	9	0	♏	0	40	Nor.
The North ſtarre of the ballance Libra:	13	10	♏	9	0	Nor.
The left hand of Serpentarius.	72	0	♏	17	0	Nor.
The bright ſtarre of Ariadnes crowne.	5	30	♏	44	30	Nor.
The heart of the Scorpion.	3	30	♐	3	30	Sou.
The head of Hercules	8	40	♐	37	30	Nor.
The head of Serpentarius	15	30	♐	36	0	Sou.
The head of the Dragon	20	20	♐	76	0	Nor.
The bright ſtarre of Lyra	9	0	♑	62	0	Nor.
The Eagle alias vultur volans.	24	50	♑	29	20	Nor.
The firſt ſtarre of the taile of Capricoorne	16	0	♒	2	0	Sou.
The following ſtarre thereof	17	10	♒	2	0	Sou.
The taile of the Dolphin	8	10	♒	29	30	Nor.
The Fomahant,	28	0	♒	23	0	Sou.
The point of the dart	1	10	♒	39	30	Nor.
The taile of the Swanne	0	20	♓	60	0	Nor.
The right thigh of Pegaſus.	22	50	♓	31	0	Nor.
The ſtyle of the Whale.	27	0	♓	20	20	Sou.

How to finde out the right and oblique aſcention of any ſtarre and alſo the aſcentionall difference.

Propoſition. 32.

THe right aſcention of any ſtar is an arch or portion of the Equator, to bee counted from the firſt point of Aries according to the ſucceſſion of the ſignes, with which portion in a right Spheare any ſtarre both riſeth, mounteth to the meridian, and ſetteth: and in an oblique Spheare it is a portion of the Equator, wherewith the ſtar is mounted to the Meridian: as for example, in a right Spheare the ſtar called Cor Leonis, that is to ſay, the hart of the

Lyon

Declination.	No. & South.	Magnitudes or greatnes.	The right Ascention. Degr.	Min.	The nature of the stars shewed by the characters of the Planets	The right ascension of the arch Ecliptique answering the star		The characters of the signes.
40 0	Nor.	3	213	0	♄ ♀	5	0	♏
22 30	Sou.	3	176	43	♄	26	20	♍
22 0	Nor.	1	209	0	♃ ♂	1	0	♏
10 0	Sou.	1	195	10	♂ ♀	16	30	♎
21 0	Sou.	3	234	0	♂ ♄	26	30	♏
14 0	Sou.	2	217	0	♄ ♂	9	20	♏
8 0	Sou.	2	223	10	♃ ☿	15	46	♏
3 30	Sou.	3	238	30	♄ ♀	30	0	♏
28 0	Nor.	2	229	0	♀ ☿	21	20	♏
25 0	Sou.	2	241	0	♃ ♂	3	0	♐
15 0	Nor.	3	252	35	☿	14	0	♐
12 50	Nor.	3	258	30	♂ ☿	19	10	♐
52 0	Nor.	3	266	10	♄ ♂	26	30	♐
38 20	Nor.	1	275	20	♀ ☿	5	0	♑
7 30	Nor.	2	210	40	♄ ♂	20	4	♑
18 0	Sou.	3	319	0	♃ ♄	17	0	♒
17 30	Sou.	3	320	10	♃ ♄	18	0	♒
10 0	Nor.	3	304	0	♄ ♂	1	10	♒
33 10	Sou.	1	339	0	♀ ☿	7	0	♓
18 10	Nor.	4	295	0	♂ ♀	23	8	♑
43 30	Nor	2	307	10	♂ ☿	5	0	♒
25 0	Nor.	2	341	0	♃ ♂	9	30	♓
19 50	Sou.	3	5	35	♄	6	0	♈

Lyon, both riseth, mounteth, and setteth with the 145. deg. 30. of the Equinoctiall. But the right ascention of the saide starre in an oblique Spheare, is to be found onely by bringing the said starre to the Meridian, and you shall find it to bee all one with the right ascention in a right Spheare, for by bringing the starre called Cor Leonis to the Meridian in an oblique Spheare, you shall finde the right ascention thereof to bee all one with that which it had in a right Spheare, that is, 145. degrees 30. of the Equinoctiall. But if you would know the oblique ascention of any star then hauing set the Globe at your Latitude, bring the star to the East part of the Horizon, & marke what degree of the Equinoctial

riseth therewith, and that is the oblique ascention: As for example the Globe standing at the Latitude 52. bring the starre Cor Leonis, to the East part of the Horizon, & by staying the Globe there you shall find the 127. degree of the Equinoctiall to rise with that starre. Now if you would know the ascentionall difference, that is to say, the difference betwixt the right and oblique ascention you haue no more to doe but to subtract the lesser out of the greater, and the remainder shall bee the ascentionall difference, as in the former example, take 127. degrees out of 145. degrees & 30. and there shall remaine 18. degrees 30. and that is the ascentionall difference, by helpe whereof you may know the encrease and decrease of the artificiall day and night throughout the yeare in any Latitude, if you obserue that order which I haue already set downe in the first part of my Spheare, the 50. Chapter.

To know in what quantitie of time any whole signe or any other Arch of the Ecliptique doth rise or set.

The 33. Proposition.

HAuing set the Globe at your latitude, and rectified the Index of the houre wheele by the seauenth Proposition, bring the beginning of any Arch or signe to the East part of the Horizon, and marke what degree of the Equinoctiall riseth therewith, that done bring the end of the said signe or Arche to the East part of the Horizon, and marke there also what degree of the Equinoctiall toucheth the Horizon, and staying the Globe there, looke how many houres or parts of houres the Index of the houre-wheele hath runne betwixt the beginning and ending of the said signe or arch, and so you shall know the quantity of that time, you may know it also by the number of degrees of the Equinoctiall contayned betwixt the beginning and ending of the said signe or arch by allowing 15. degrees to an houre, and 4′. to a degree As for example, supposing the Sunne to bee in the first degree of Taurus, you shall finde by working according to the rule before set downe, that the whole signe of Taurus doth spend in rising

one

one houre 8'. Now if you will know how much time he spendeth in descending, bring the first degree of Taurus to the West part of the Horizon, marking what degree of the Equinoctiall toucheth the Horizon at that instant, and also to what houre the Inder pointeth, then turne the Globe still Westwarde vntill the last degree of Taurus meeteth euen with the edge of the Horizon, and then marke againe aswell the degrees of the Equinoctiall that toucheth the Horizon, as also to what houre the Inder pointeth, and you shall finde the number of degrees of the Equinoctiall to bee 42. degrees, which maketh two houres 48. minutes, which is answerable to the houre of the houre-wheele: and so much time the whole signe of Taurus spendeth in his descention or going downe.

How to know by the Globe what stars doe rise or set euery day Cosmicallie, acronicallie, or Helicallie.

Proposition 34.

As for the threefold Poeticall rising & setting of the stars, you shall find them plainly defined in the first part of my Spheare, Chap. 35. but to find out the same by the Globe you must do thus. First hauing set your Globe at your Latitude, and sought out the place of the sun for that day, bring the degree of the Sun to the East part of the Horizon, and stay the Globe there, that you may see what starrs do rise a little before the sunne, and which rise together with the sunne. For those that rise a little before the sunne, are said to rise Helically, and those that rise together with the Sunne are sayde to rise Cosmically, and those Starres that are in the very West part of the Horizon at the rising of the Sunne, are said to set Cosmically. Againe those starres that rise immediately after the sunne doe set Helically, that done, turne the degree of the Sunne vnto the West part of the Horizon, and staying the Globe there marke what starres are ready to goe downe with him, for those are sayde

to set Acronically, and staying the Globe still there in the West, marke what starres at that present do rise in the East part of the Horizon, for those are said to rise Acronically.

To know in what time of the yeare any starre riseth or setteth, eyther Cosmically, or Acronically

The 35. Proposition.



HEre hauing set the Globe at your Latitude, and knowing the degree of the Sunne, bring the star to the East part of the Horizon, and therewith consider what degree of the Ecliptique the Horizon cutteth at that present, that done find out the selfe same degree vpon the Horizõ in the narrow space of degrees nert vnto the body of the Globe, and right against that degree, you shall finde in what day and moneth that starre doth rise Cosmically. As for example, I would know at what time of the yeare Cor Leonis riseth Cosmically in the Latitude 52. I bring the starre Cor Leonis to the East part of the Horizon, and I finde that the Horizon cutteth the Ecliptique in the 23. degree 30. of Leo, which degree being found againe vpon the Horizon, pointeth to the first day of August, so as I conclude that Cor Leonis doth rise that present day Cosmically, for then both hee and the sunne are in a manner in one selfe degree of the Ecliptique: nowe to know the Cosmicall setting of the said starre, turne the same starre to the West parte of the Horizon, and marke what degree of the Ecliptique doth then rise in the East, and you shall finde the same to be the 23. degree of Aquarius, which degree being founde againe vpon the Horizon in the narrowe space of degrees nert to the body of the Globe, containing the degrees of the Zodiaque, will point to the 31. day of January, at which time the sunne is opposite to the said starre, and therefore it is saide to go downe Cosmically, because it goeth downe when the Sunne riseth. Now to know the Acronicall rysing of any star at any time, bring the starre to the East part of the Horizon, and marke therewith what degree of the Ecliptique goeth down in the West at that in-

stant

ſtant, for the ſunne being in that degree is oppoſite to the ſtar: As for example, by bringing the ſtarre Cor Leonis to the Eaſt part of the Horizon, you ſhall find that the 23. deg. of Aquarius goeth downe at that inſtant, which degree being found againe vppon the Horizon, will ſhew the day and moneth when the ſtarre riſeth Acronically, and ſo you ſhall finde the ſtarre Cor Leonis to riſe Acronically the 31 day of January. Contrariewiſe if you woulde know when the ſaid ſtarre ſetteth Acronically, bring the ſaide ſtar Cor Leonis, to the Weſt part of the Horizon, and therwith marke what degree of the Ecliptique then ſetteth in the Weſt, which degree being found againe vpon the Horizon, will ſhew that the ſaid ſtarre ſetteth Acronically the 6. of Auguſt.

Of the Horoſcope and the reſt of the 12. houſes.

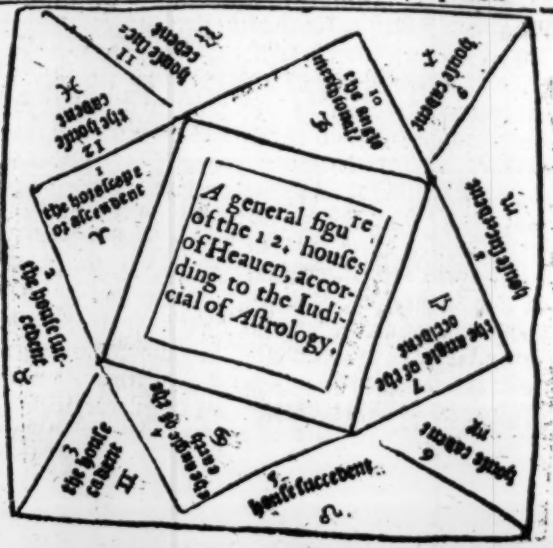
The 36. Propoſition.

THis word Horoſcope doth not onely ſignifie the degree of the Ecliptique, otherwiſe called the aſcendent, which riſeth aboue the Horizon in the beginning of any thing that is to bee ſought or knowne, but alſo ſometimes the whole figure of heauen containing the 12. houſes, and doth ſhewe the very ſecrets of nature, ſo that there is nothing that chanceth to the inferiour bodies, but ſome cauſe thereof doth appeare by meane of the Horoſcope in heauen, and therefore the Aſtrologians haue diuided the whole heauen into 12. houſes, which are numbred from the Horoſcope, which is the Eaſt Angle, and ſo forth according to the ſucceſſion of the ſignes, of which 12. houſes the foure principall are foure pointes of the Zodiaque whereof two do fall vpon the Horizon, and the other two vpon the Meridian, and are called principall pointes, poles or Angles, that is the beginning of the firſt houſe, of the fourth houſe, of the ſeauenth houſe, and of the tenth houſe, and thoſe that do follow next any of theſe principall Angles, are called ſucceeding houſes, in Latine Succedentes, as the ſeconde, the fifth, the eyghe, and the eleauenth houſe. And thoſe that goe next before any of the foure principall

Angles

Angles, are called falling houses, in Latine Cadentes, as the 12. the third, the sixth, and the ninth: and such houses as haue no familiaritie with the Horoscop or ascendent, as the second, the sixth, the eight, and the eleuenth houses are said to bee slow and defect, all which things this Table here following both shew containing the number and names of the houses, and also their significations

The 12 houses	The names of the houses.		The significations of the houses
1	Angle	East	life
2	succeeding	the lower gate	gaine
3	falling	the Goddesse	brethren
4	Angle	the bottom of heauen	parents
5	succeeding	good fortune	children
6	falling	euill fortune	health
7	Angle	the West	wife
8	succeeding	the higher gate	death
9	falling	God	religion
10	Angle	the middle of heauen	kingdome
11	succeeding	the good spirit	benefactor
12	falling	the euill spirite	prison



How to find out the Horoſcop or aſcendent at any time of the day or night by the Globe, and thereby to know the 4. principall angles of heauen.

Propoſition. 37.



Firſt hauing ſet the Globe at your Latitude, and rectified the Inder of the houre wheele according to the degree of the ſigne wherin the Sunne is that day you ſeeke by the 7. propoſition, if it bee in the day time, take with your Aſtrolabe or Quadrant the altitude of the Sunne. But if it be in the night take the altitude of ſome knowne Starre, that thereby you may knowe the houre of the day or night in which you ſeeke the aſcendent. But if it happen that neither Sunne nor Starre is to bee ſeene that day or night then learne by ſome true clocke or watch what houre it is, and hauing ſet the Inder of the houre wheele at that houre ſtay the Globe there, and therewith marke what degree of the Ecliptique riſeth in the Eaſt parte of the Globe aboue the Horizon at that inſtant, and that degree is the Horoſcop or aſcendent for that houre. As for example, you would find out the aſcendent the 16. of June 1590. at 8. of the clock in the forenoone at which day the Sunne is in the 4. degree of Cancer, here hauing firſt ſet the Inder of the houre wheele at that houre by ſtaying the Globe there, you ſhall finde that the 21. degree 30′ of Leo is the aſcendent, which is the Eaſt angle or firſt houſe, whereby you may alſo at that inſtant find out the other three angles, that is the weſt South, and North angles, for the oppoſite point of the Zodiaque to the aſcendent is the Weſt angle or ſeuenth houſe. And that degree of the Zodiaque, which is at that inſtant right vnder the Meridian aboue head in the South angle or 10. houſe and the oppoſite point to that beneath, is the North angle or fourth houſe, for hauing found the aſcendent, which is the Eaſt angle or firſt houſe to be the 21. degree, 30. minutes of Leo, the Weſt angle muſt needes be the 21. degree 30. minutes of Aquarius. Againe the ſouth angle or 10. houſe is the 8. degree of Taurus, and the oppoſite

posite point that is in the North Angles or fourth house which is the 7 of Scorpio

How to erect a Figure by the Globe according to Regio Montanus his way which is called the reasonable way, and is counted the best of all others.

Proposition. 38.



IRST you must find out the degree of the ascendent, as is taught in the last Chapter, which is alwaies the first house, then staying the Globe with some prettie wedges of woode being thrust betwixt the Horizon & the body of the Globe marke there what degree of the Equinoctiall doth touch the Horizon at that instant, and number from thence vpwarde vppon the saide Equinoctiall thirtie degrees, to the ende of which thirtie degrees, bring the semicircle of position beeing first fastened in his due place vppon the East side of the Horizon, and looke what degree and signe of the Zodiaque the circle of position cutteth at that present, and that degree shall bee the twelfth house: then number againe other 30, degrees vppon the Equinoctiall vpwardes towardes the brazen Meridian, and to that bring the semicircle of position, marking what degree of the Zodiaque the said semicircle cutteth, and that shall bee the 11. house, that done, looke what degree of the Zodiaque is right vnder the brazen Meridian aboue head, and that shall bee the 10 house. Then hauing set the semicircle of position vppon the West side of the Globe, number from the brazen Meridian Westward vppon the Equinoctiall other 30 degrees to the end wherof bring the semicircle of position, and marke what degree of the Zodiaque the circle of position cutteth, and that shall bee the 9 house, then from thence downeward number vppon the Equinoctiall other 30. degrees, to the ende whereof bring the Semicircle of position, marking there what signe and degree of the Zodiaque the said Semicircle cutteth, and that shall be the 8 house. Now hauing these fiue houses, the opposite pointes of the said fiue houses will shew you the other fiue houses

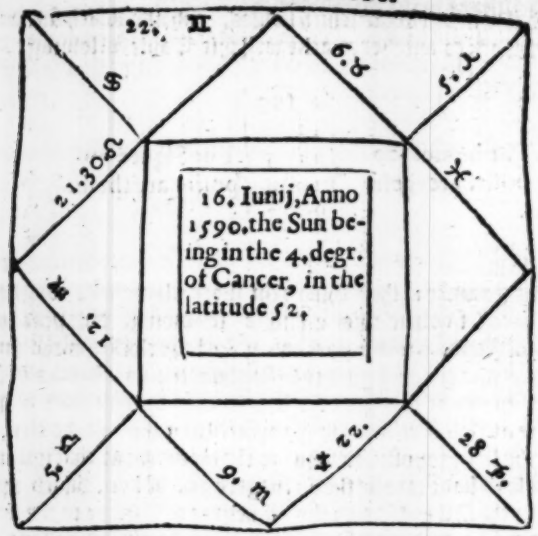
and

and if you will know which houſes, and alſo which ſignes are oppoſite one to another, marke well this Table following.

The houſes oppoſite are theſe,		The Signes oppoſite are theſe	
1	to 7	♈	to ♎
12	6	♉	♍
11	5	♊	♐
10	4	♋	♑
9	3	♌	♒
8	2	♍	♓

And to make al theſe things the more plaine vnto you, I thought good to ſet downe this example following. Suppoſe that the 16. of June, Anno 1590. and at 8. of the clocke in the morning you would erect a figure to know how the 12. houſes of heauen are ſituated at that preſent, firſt hauing drawne ſuch a ſquare figure as this here following, repreſenting the 12. houſes, learne by the laſt propoſition who is the aſcendent at that inſtant, and you ſhall finde it to be the 21. degree 30. of Leo. which muſt bee ſet in the firſt houſe, and the 28. degree of Cancer in the 12. houſe and the 22. degree of Gemini in the 11. houſe, and in the 9. degree of Taurus in the 10. houſe, and the 5. degree of Aries to be in the 9. houſe and the 12. degree of Piſces in the 8. houſe. Now the oppoſite houſe to the firſt houſe or aſcendent is the 7. houſe which is the 21. degree 30. of Aquarius, for the oppoſite ſigne muſt alwaies haue like number of degrees, then the oppoſite to the 12. houſe is the 6. houſe, which is the 28. deg. of Capricorne, and the oppoſite to the 11. is the 5. houſe, which is the 22. degree of Sagittarius, and the oppoſite to the 10. houſe is the 4. houſe, which is the 9. degree of Scorpio, and the oppoſite to the 9. houſe is the 3. houſe, which is 5. degree of Libra, and the oppoſite to the 8. houſe is the ſecond houſe which is the 12. degree of Virgo, all which things this figure here following doth plainely ſhew. And if you would know what planets ſhould be placed in euerie houſe, you muſt learne that out of the Ephemerides, or out of ſome of the Aſtronomicall Tables.

Now



Now becauſe moſt men that do ſhew the vſe of the Globes, do alſo teach therein how to finde out the latitude and longitude of any region, I thought good therefore to ſet downe here ſome of their manifold wayes touching the finding out of the ſame, notwithſtanding that I haue already written ſomething thereof in the ſecond part of my Spheare, in the 8, 9. 10. & 11. chapters.

How to know the latitude of any place or region by any of the fixed ſtarres deſcribed in the Globe.

Propoſition. 39.

TAke in the night ſeaſon with your Aſtrolabe the Meridian altitude of ſome knowne ſtarre that is to be founde in the Globe, then hauing brought the ſtarre vnder the brazen Meridian, turne the Meridian vp and downe in the nickes of the Horizon, vntill the ſame Starre haue the ſaide

said altitude in the brazen Meridian, which you found it to haue in the firmament by your Astrolabe, that done, number the degrees of the Meridian contained betwixt the Pole and the Horizon, and that is the latitude of that place.

Another way to find the eleuation of the Pole.

The 40. Proposition.

HAuing brought the globe into an open place where the Sunne shineth at noonetide, and placed the same right North and South as is taught in the first chapter, set a needle in the degree of the Sunne, and bring the same to the brazen Meridian, not leauing to turne the same Meridian vp and downe in the nicks of the Horizon, vntill the needle cast no shadow at all, and there staying the Globe, looke how many degrees the Pole is eleuated aboue the Horizon, for that is the latitude of that place.

A third way to find out the latitude of any place without taking the Meridian altitude of any Starre.

The 41. Proposition.

TAke at any houre the altitude of 2 knowne starres, and such as are to be found in the Globe at one selfe instant whereof the one must be situated towardes the East, and the other towardes the West, then turne the Globe together with the Meridian vp and downe in the nicks of the Horizon, vntill you finde by helpe of the quarter of altitude each starre to haue the selfe same altitude in the Globe, that it had in heauen, which being done, looke how many degrees the North Pole is eleuated aboue the Horizon, and that is the latitude of that place. But if you would know the latitude of any place that is towards the South Pole, then you must first place the South Pole aboue the Horizon, & then worke as before.

A fourth way to finde out the latitude of any region by any knowne fixed ſtarre or Planet that may be ſeene.

Propoſition. 42.

FIrſt take his Meridian altitude, and then learne to know either by the Globe or by ſome table his declination, which if it be Northerne you muſt ſubtract the ſame from the Meridian altitude, if Southern adde it to the Meridian altitude, ſo ſhall you haue the eleuation of the Equinoctiall, which being ſubtracted from 90, the remainder ſhall be the latitude of that place, as for example I find the Meridian altitude of Oculus Tauri to be 53. degrees, 50′. 32″. and his declination Northward to be 15. degrees, 50′. 32″, which declination being ſubtracted from the Meridian altitude, there remaineth 38. degrees, and that is the eleuation of the Equinoctiall, which being ſubtracted from 90, there remaineth 52. for the latitude of that place.

Hitherto I haue ſet downe the chiefeſt propoſitions that are to be done by the Globe, touching the Sunne and the fixed Starres: & laſtly ſhewed how to find out the latitude of any place, wherfore now I thinke good to ſhew you how to finde out the place of the Moone, and of euery one of the reſt of the Planets in the Globe by helpe of the Ephemerides, and thereby to know when euery Planet riſeth and ſetteth, and firſt of the Moone.

A briefe deſcription of the diurnall table ſet down in Stadius his Ephemerides, together with the vſe thereof.

Propoſition. 43.

BVt for as much as the diurnall Table of the Ephemerides ſhewing the dayly motion of the Planets is very needfull to ſerue diuers turnes, I thinke it not amiſſe here briefly to deſcribe the ſame, & ſpecially that of Iohannes Stadius whoſe diurnal table or Almanack beginning

at

at the 202. page of his booke, and at the yeare of our Lord 1583. continueth to the yeare 1606.

Of which Table euery page on the left hand is diuided into 9. collums. In the firſt collum whereof on the left hand are ſet downe the daies of the moneth, firſt the Gregorian daies, according to the Romane account, and next to that the daies of the moneth according to our Engliſh account, then in the front of euery other collum are ſet downe the characters firſt of the Sunne, and then of other the fiue Planets that is to ſay, of the Moone, Saturne, Iupiter, Mars, Venus, Mercurie, & laſt of all, the head of the Dragon figured thus ☊. And right vnder theſe ſeuen Planets, & alſo vnder the head of the Dragon are ſet downe the ſignes and degrées whereon euery of theſe is euery day of the moneth throughout the yeare at noone tide, and in the foote of the ſaid Table is ſet downe the Latitude of euery one of the 5. Planets, proceeding by the daies of the moneth deuided into three partes. And in the margent of euery left page are ſet downe the chiefeſt feaſtes and Saints daies that fall in euery moneth throughout the yeare. Moreouer, there is a Table on the right hand right againſt the left Table, in which are ſet downe firſt the daies of the moneth, and then what coniunction or any other aſpect the Moone hath with any of the other fiue Planets, that is, with the Sunne, with Saturne, with Iupiter, with Mars, with Venus, and with Mercurie, which Planets are ſet downe in the front of the ſaid Table, and vnder them the Characters of ſuch aſpectes as the Moone hath that day with any of the other Planets. The Characters of which aſpects are theſe here following.

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Whereof the firſt ſignifieth a coniunction, the ſecond an oppoſition, the third a trine aſpect, the fourth a quadrat aſpect, and the fift a ſextile aſpect.

Two Planets are ſaid to be in a coniunction when they are both in one ſelfe ſigne. And to be in an oppoſition when they are in two ſeuerall ſignes oppoſite one to another. For then they be diſtant one from another 6. ſignes. And they are ſaid to be in trine aſpect when they be diſtant one frō another by foure ſignes. And to be in a quadrat aſpect when they are diſtant one from a-

not her by three signes. And to be in a sextile aspect when they are distant but two signes one from another.

How to finde out the place of any Planet by the Ephemerides.

Proposition. 44.

NOw to find out the place of any Planet, or of the head of the Dragon by this diurnall Table, you must first seeke out the day of the moneth in the first collum of the left table, right against that on your right hand in the said left Table, you shall find in the common angle right under the Planet or Dragons head (which soeuer of them you seeke) the signe and degree wherein the said Planet or Dragons head is the said day at noone tide.

And to finde out the aspects which the Moone hath with any of the Planets the same day, you must resort to the other Table on the right hand, obseruing like order as before.

The example.

As for example the 21. of Aprill 1592. which is the first of May, according to the Romaine account, I find by the table on the left hand, the Sunne to be in the 10. degree 5′0. of Taurus, the Moone to be in the third degree, 47. of Capricorne, Saturne, to be in the 8. degree, 1′0. of Cancer, Iupiter to be in the 18. degree, 2′8. of Sagittarius, Mars to be in the 12. degree, 6′0. of Gemini, Venus to be in the 2. degree, 0′0. of Aries, and Mercurie to be in the 6. degree, 2′0. of Taurus, and the head of the Dragon to be in the 29. degree, 45. of Gemini.

And right against this in the Table on the right hand you shall finde the Moone to be in a trine aspect with the Sunne, to be in an opposition with Saturne, to be in a trine aspect with Mercurie.

Thus

Thus hauing briefly shewed the vse of the diurnall Table, I will shew you now how to finde out ☽ latitude of the Moone as well North as South, by helpe of Stadius his Table, set down in the 112. page of his Ephemerides, and first I will briefly describe the said Table.

A briefe description of the Table of *Stadius* set down in the 112. page of his Ephemerides to find out thereby the daily Latitude of the Moone, be it North or South, together with the Canon or rule thereof plainely declared by example.

Proposition. 45.

This Table is deuided into eight collums, whereof the first on the left hande contayneth the degrees of euery signe set downe in the front of the Table, which degrees are to be counted descending from one to 30. for so many degrees there be in euery signe: and the last collum on the right hand containeth the like number of degrees belonging to the signes set downe in the base or foote of the sayde Table, and this number ascendeth vpward from one to 30. and for that purpose it would not haue beene amisse to haue set ouer each heade of those two collums this word gradus, next vnder the word Signa. And of the other fiue collums the first three on the left hand doe containe the degrees, minutes and seconds of the North Latitude, and the other three towards the right hand do containe the degrees, minutes, and seconds of South Latitude Moreouer, the 12. signes are to be numbred in the front from the thirde collum on the left hand from 1. to 5 forwarde toward the right hand, and at the foote from 6. to 11. backwarde towards the left hand, set downe in arithmeticall figures.

The rule or Canon together with a plaine example ſhewing the vſe of the Table.

FIrſt knowing the day of the moneth, reſort vnto the diurnall Table of motion of the Planets in the Ephemerides, and hauing there found out the motion or place of the Moone, and alſo of the Dragons heade anſwerable to the day wherein you ſeeke, ſubtract the place of the Dragons heade from the place of the Moon, which is eaſily done ſo often as the Arke of the Moone is greater, that is to ſay, containeth more ſignes and degrees than the arke of the Dragons heade, beginning your account in both arkes from the firſt point of Aries. But if the arke of the Moone be leſſer than the arke of the Dragons head, ſo as you cannot make your ſubtraction, then you muſt adde to the place of the Moone 12. ſignes, which is 360. degrees, and you muſt adde alſo thereunto the number of ſo many ſignes as are contained betwixt the firſt point of Aries, and the firſt point of that ſigne wherein the Moone is at that preſent, which ſigne it ſelfe is not to be numbred, and when you come take out of that whole ſumme the place of the Dragons head, you muſt firſt adde to the ſaide place of the Dragons head the number of ſo many ſignes as are contained betwixt the firſt point of Aries, and the firſt point of that ſigne wherein the Dragons head is at that inſtant, but not the ſigne wherein it is, and then hauing made your ſubtraction, remember alwaies to take out of that remainder 90. degrees, which is three ſignes, ſo oft as you haue neede to adde 12. ſignes to the place of the Moone, and not otherwiſe, and with that remainder you muſt reſort to the foreſaid table of the Moones latitude, as for example.

The Example.

Suppoſe that you would know what Latitude the Moone had the firſt of Nouember 1590. here reſorting to the diurnall Table of the Ephemerides, you find according to the day propoſided, the place of the Moone to be in the 16. degree 49. of Taurus, and the place

place of the Dragons head to be in the 28. degrés 1′4. of Cancer. Now according to the rule before giuen, you muſt take the place of the Dragon here, which is 28. degrées, 1′4. of Cancer out of the 16. degree 4′9. of Taurus, which is the place of the Moone, and becauſe you cannot take the greater ſumme out of the leſſer, you muſt adde out to the leſſer ſum 12. ſignes, which make 360. degrees, and alſo one ſigne, for Aries going next before Taurus, in which ſigne the Moone is, ſo ſhall you make the whole ſumme to be 13. ſignes 16. degrees 4′9. out of which ſumme you muſt ſubtract the Dragons head, which with the ſignes that goe next before Cancer counting from the firſt point of Aries, doe make 3. ſignes 28. degrees, 1′4. which being ſubtracted out of 13. ſignes, 16. degrees, 4′9. there remaineth 9. ſignes, 18. degrees, 3′5. out of which you muſt alſo ſubtract 90. degrees, which is three whole ſignes, and ſo you find the remainder to be 6. ſignes, 18. degrees 3′5. with which laſt remainder you haue to enter into the Table of the Moones Latitude, in the forte whereof you ſhall finde 6. ſignes, and in the laſt collum on the right hand 18. and in the next collum towards the left hand, and in the common angle anſwerable as well to the ſaid 18. degree, as alſo to the 6. ſignes, you ſhall find the Latitude of the Moone to be 4. degrees, 4′5. and 17″. (which ſeconds may be very well omitted) and her Latitude to be South. But now becauſe there are 3′5. more annexed to the 18. degrees of the foreſaid remainder, you muſt finde out a proportionall part anſwerable to thoſe minutes which is to be done thus.

Take out of the Table the whole Latitude anſwerable to 6. ſignes and 19. degrees, which is one degrée more, ſo as now the Latitude of the Moone is 4. degrées, 4′3. omitting the ſeconds. Then ſubtract 4. degrées 4′3. out of 4. degrées 4′5. and there remaineth 2′. Now to finde out a proportionall part anſwerable to the former 3′5. you muſt ſay thus. If 6′0. require 2′. what ſhall 3′5. require? and the quotient yeeldeth 1′. 1″0. which being ſubtracted out of 4. degrees 4′5. there will remaine 4. degrees 4′4. and ſo much was the South Latitude of the Moone at that preſent day.

How to know the true place of the Sun or Moone, or of any other Planet euery houre of the day through out the yeare.

Propoſition. 46.

BVt now becauſe that to finde out the true place of the Moone or of any other Planet in the Globe to worke thereby certainely and truely it is not inough to know their places in the Zodiaque at noonetide, vnleſſe you know the ſame at the very houre in which you ſeeke. Stadius teacheth a briefe rule to find out the true place of any Planet at what houre ſoeuer you deſire by helpe of a ſhort Table ſet downe in the 109. page of his Ephemerides, which rule & Table he borrowed of Reinholdus. And this Table conſiſteth of 3. collums, in euery front whereof are ſet firſt degrées, minutes, ſeconds, and thirds, & vnder them minutes, ſeconds, thirds, and fourthes. And note that the firſt row of numbers on the left hand ſignifieth ſometime degrées, and ſometime minutes, either of which doe extend in this Table to 60. and to 61. right againſt which row in euery collum is ſet downe on the right hand the proportionall part for one houre, the rule is thus.

The Rule.

Firſt finde out by the Ephemerides the place of the Planet wherein it is at noonetide the ſame day that you ſeeke, and alſo the place of the ſame Planet, wherein it is the next day following at noone, and ſubtract the leſſer out of the greater, if the two places at noonetide be ſtill in one ſelfe ſigne, but if the two places be in two ſeuerall ſignes, then you muſt count how many degrées of the Ecliptique the one place is diſtant from the other, and that ſhall be the difference, with which difference you muſt reſort to the Table, and right againſt that on the right hand in the ſame collum wherein you found the difference, you ſhall alſo find the proportionall

portionall part for one houre, as by this example you ſhall more plainely vnderſtand.

The Example.

Suppoſe then that you deſire to knowe the true place of the Sunne or of the Moone, or of any other Planet at fiue of the clocke in the after noone the 30. of December 1591. at which day you finde the Sun at noonetyde to be in the 18. degree, and 7. minutes of Capricorne, and the nert day at noone to be in the 19. degree and 8′. of the ſame ſigne, the difference whereof you finde by ſubtraction to be one degree and one minute, with which difference you muſt enter into the table, and ſeeking for one degree in the firſt collum on the left hande, you finde next vnto that on the right hand 2′.3″0. then for one minute which before was named one degree, you finde next vnto it 2″.3‴0. which being added to the former ſumme laſt found, maketh 2′.3″2.3‴0. which is the proportionall part for one houre. Then hauing multiplyed that by 5. houres to ſerue 5. of the clocke in the afternoone, you ſhall finde the product to be 1′2.4″2.30‴. which being added to the firſt Meridian place, which is 18. degrees and 7. minutes of Capricorne, maketh in all 18. degrees 1′9.4″2.30‴. And remember that if your difference be onely minutes, then the body of the Table doth ſhew the proportionall part. But if the difference doth containe degrees, then the fourths muſt bee made thirds, and the thirds ſecondes, the ſeconds minutes, and the minutes degrees And this table ſerueth for the 7. Planets for euer. Notwithſtanding Stadius ſetteth downe another Table to finde out thereby the proportional mouing of the Moone ſeruing as well for houres as for minutes of houres, which table beginneth at the 144. page and endeth at the 184. page of his booke.

In ỹ front of which table in euery page are ſet downe the differences of the two places of the Planets which you haue found by ſubtracting the leſſer out of the greater, if the planet be at both noonetides in one ſelfe ſigne, but if ſhe be at the two noonetides in two ſeuerall ſignes, then ſuch difference is to be accounted vpon the Ecliptique line, to know how many degrees the one place is

diſtant from the other, and as for the minutes, if there be any, you may know the difference thereof by ſubtracting the leſſer number out of the greater. And in the outermoſt collum on the left hand are ſet downe the houres and minutes marked in the foote with the letter H. ſignifying houres, and vnder that with the letter M. ſignifying minutes whereof the houres proceede but to 24. but the minutes extend to 60. which make one houre proceeding by euen numbers in this ſorte. 1.2.4.6.8. &c. and therefore not finding that houre or minute which you ſeeke in the ſaide collum, you muſt take the next number which is leſſer by one, and ſo make it vp by adding the firſt & onely adde one vnto it, and in ech common angle you ſhall find the proportionall part that is to bee added to the firſt place of the Planet anſwering to the day of the moneth wherein you ſought. All which things you ſhall more plainely vnderſtand by this one example.

The example.

Suppoſe then that you would knowe the true place of the Moone at 5. of the clocke, 17′. in the afternoone the 28. of December 1591. and looking in the Ephemerides you finde the place of the Moone to be the ſame day at noonetide in the 26. degree, 12′ of Libra. & the next day at noonetide to be in the 8. deg. 17′. of Scorpio, here by numbring how many degrees are contained in the Ecliptique line betwixt thoſe two places, and by ſubtracting the leſſer number of minutes out of the greater, you ſhall finde the difference to be 12. degrees 5′ with which difference you muſt reſorte to the Table of proportional partes, and there hauing found the ſaid difference in the front of the 13. page of the ſaid table, look in the firſt collum on the left hand, for the houres and minutes according to the rule before ſet downe. As heere in this example becauſe you cannot finde 5. houres, you take foure, right againſt which on the right hand in the common angle you ſhall find 2. degrees 0′.5″0. then for one houre to make the 5. houres, you ſhall finde in the common angle 3′0. 1″2. that done, ſeeke out the 17′. in the firſt collum, which number not being there, you muſt take 16. againſt which in the common angle you ſhall find 8′.3″.23‴. and

for

for the one minute which is to be added to 16. you shall finde in the common angle against that one minute 30″.12‴. and by adding all these summes together, you shall finde the proportionall part to be 12.degr.39′.35″.32‴. which being added to the place of the Moone at noone tide first found in the Ephemerides, maketh in all 28.degrees, 51′.35″.32‴. of Libra, which is the true place of the Moone for that houre. But you haue to note that the denominations of the numbers contained in the common angles of proportionall parts be not alwaies like, for when they are to answere houres then the first number on the left hand in euery angle signifieth degrees, and the rest minutes & seconds, but if they haue to answere minutes of houres, then the first numbers doe signifie minutes, and rest seconds and thirds, as you may easily perceiue by examining the former example. But now to returne to my first intention, which was to shew you how to finde out the true place of euery Planet in the Globe, you haue to vnderstand that hauing found out the true place of any planet at the day and houre wherein you seeke by such meanes as is before taught, then resort to the celestiall Globe, and hauing set the same at your latitude, and also rectified the houre wheele according to the day wherein you seeke. Suppose that the 26. of May 1592. you would know in what part of the Globe the Moone is to be found at 5. of the clocke in the afternoone. Here first you must know her place at noone the same day, which is the 14. degree, 28′. of Aries, and also her place the nert day at noone which is the 29. degree 0′. of the same signe: Now by taking 14. degrees 28′. out of 29. degrees, you shal finde the remainder to be 14. degrees, 32′. with which difference you must resort to the table set downe in the 109. page. And by working as before is taught, you shall finde her place or longitude to be at fiue of the clocke in the 17. degree 23′.6″.43‴. of Aris, which being counted vpon the Ecliptique line of the Globe, lay your semicircle of longitude and latitude to that point, and hauing learned her latitude by helpe of the Table of latitude before mentioned, by which you shall finde her latitude to be at that time 4.deg.46′. to the southward, then hauing counted that latitude vpō the semicircle of longitude & latitude, make there a mark vpon ỳ Globe, for that is her very place at that instant, that is to

say,

say at 5. of the clocke in the afternoone the 26. day of May 1592.

Now if you would know when she riseth and setteth, you haue no more to doe but to bring her place before marked on the Globe vnto the Horizon on the East part, and the Inder of the houre wheele being rectified as is before said, will shew the houre of her rising aboue the Horizon. and by bringing her place to the West part of the Horizon, the Inder will shew the houre of her setting, and by bringing her place to the brazen Meridian, you shall know at what houre she is full South, The like tables you shall finde also in Stadius to finde out the true place of eury other Planet at any houre, as of Saturne, Iupiter, Mars, Venus, and Mercurie, which Tables do beginne at the 128. page, and end at the 143. page of his booke, the order of working by which Tables is like in euery respect vnto that of the Moone last taught. By which Tables you may finde out the true place of any other Planet in the Globe at any houre of the day or night, and thereby to know the houre of his rising and setting if you rightly obserue the rules before taught touching the vse of the foresaid Tables. And note that you may finde out the place of the Moone by the Globe with out the helpe of any Ephemerides, by such wayes as here doe follow.

How to finde out the place of the Moone by the Globe when she is aboue the Horizon without the helpe of any Ephemerides or other Table whatsoeuer.

Proposition. 42.

THauing set the Globe at your latitude, and placed it so as it may rightly answere the foure quarters of the world, take the altitude of the Moone with your Astrolabe or quadrant, and marke wherewith whether she be at that present East, or West, that is to say on this side of the Meridian, or beyond the Meridian, that done, take the altitude of some fixed star, which you know, and is to be found in the Globe, and also at that time is aboue the Horizon, marking therewith in what part of the firmament the said

Starre

Starre is, and with your crosse staffe take the distance betwixt the Moone and that Starre. Then hauing these three things, that is, the altitude of the Moone, the altitude of the starre, and also the distance betwixt the Moone and the knowne Starre. Moue the Globe together with the quarter of Altitude to and fro vntill you haue made the Moone to haue the same Altitude and like place in the Globe, that you found it to haue in the firmament, & there make a marke vpon the Globe. Then bring the quarter of altitude towardes the Starre, that the Starre may haue the like altitude and like place in the Globe that it had in the firmament, & there hauing stayed the Globe that it may not moue, take with your Compasse vpon the Equinoctiall the distance betwixt the Moone and the Starre before found by the crosse staffe, and keping your Compasses at that wideneſſe, put the firme foote of your Compasses in the fixed Starre, and cease not to moue the other foote together with the quarter of Altitude towards the marke of the Moones altitude, vntill you make them to mæte, for there is the place of the Moone.

Another way to finde out the place of the Moone without taking the altitude of any Starre.

Propoſition. 48.

Seeke by your crosse staffe to know the distance betwixt the Moone and any two starrs that you know & are to be found in the globe. That done, draw vpon the Globe on either starre an obscure circle according to the distance of the Moone from either of those two starrs, which two circles will cut or crosse one another but in 2. points, the one whereof is the place of the Moone, and which of those places it should be, your eye will easily tell you, And by this meanes it were no hard thing (as Gemma Frisius saith) for our sea men in these daies to find out all the starrs that be in the nether Hemisphere and were vn-

knowne

knowne to Ptolomie and to the other ancient Aſtronomers, and to cauſe them to be ſet downe in the Globe, yea and by this art the places of the reſt of the Planets may be found out as well according to their latitude as longitude.

Moreouer Gemma Friſius ſaith, that by knowing the true place of the Moone in the Zodiaque, you may alſo find out thereby the vnknowne Longitude of any Region.

How to find out the Longitude of any Region.

The 49. Propoſition.

HAuing found out the place of the Moone in the Zodiaque, you muſt firſt know the very houre of her being in that place, and then learne by ſome Ephemerides, or by the Tables of Alphonſus, at what houre the Moone doth enter into the ſelfe ſame degrée of the Zodiaque in ſome other Region or Towne whoſe longitude you already know, and hauing reduced the houres to 24. take the leſſer number of houres out of the greater, the remainder whereof muſt be reduced out of houres and minutes into degrees thus: Multiply the houres by 15. and the minutes of houres by 4. ſo ſhall you haue the degrees of the Equator contained betwixt the two Meridians. And ſuch diſtance ſo intercepted is called the difference of Longitude, which difference you muſt adde to the knowne Longitude if the houres in that place were more in number, but if the houres were leſſe in number, then you muſt ſubtract the foreſaid difference from the knowne longitude, ſo ſhall you collect the vnknowne longitude of that place or Region which you ſeeke, and how farre it is diſtant from the fortunate Iles.

Another way to find out the vnknowne Longitude of any place by the Globe.

The 50. Propoſition.

HAuing ſet the Globe at your Latitude and rectifie the houre-wheele by the ſeuenth Propoſition, bring the place whoſe Longitude you know to the brazen Meridian, and direct the Index of the houre wheele to that houre

houre in which the Moone doth occupie the former deſined place in that Region or Towne: that done, leaue not to turne the Globe vntill the Inder of the houre wheele come to that houre in which you ſought the vnknowne place of the Moone. and the degrees of he Equator which the brazen Meridian cutteth, will ſhew the vnknowne longitude of the place which you ſeeke.

To the ende of this Treatiſe I haue thought good to adde a briefe deſcription of the two great Globes lately ſet foorth firſt by M. Sanderſon, and then by M, Molineuh, and therewith to ſet downe a briefe deſcription of Sir Frances Drake his firſt voiage into the Weſt and Eaſt Indies, and alſo the voyage of M. Tho. Candiſh, both whoſe voyages and what courſe they held are to be ſeene by helpe of two low lines drawne on the terreſtriall Globe, of which lines the one is redde ſhewing the voyage of Sir Frances both outward and homeward. And the other line is blew ſhewing in like manner the voyage of M. Candiſh.

A briefe deſcription of the two great Globes lately ſet foorth firſt by M. Sanderſon, and then by M. Molineux.

THeſe Globes do differ in a manner nothing at all from the Globes of Mercator touching the circles before deſcribed, but onely in the Horizon, for the Horizon of theſe great Globes is deuided into 13. ſpaces as followeth.

Whereof the firſt narrow innermoſt ſpace next vnto the bodie of the Globe, containeth the degrees of the Zodiaque.

The ſecond containeth the numbers of the ſaide degrees proceeding from 10. to 30. in euery ſigne.

In

In the third space are set downe the names and the characters of the 12 signes, and also the characters of the Planets that goune vne the said signes

In the fourth space are set downe the letters of the daies of the weeke.

In the 5. and 6. are set downe the numbers of the dayes and names of the monethes according to the auncient Calender.

In the seuenth the festiuall dayes.

In the 8. and 9. space the number of the daies and names of the monethes according to the new Romaine Calender.

In the 10. & 11. are set down the numbers of the daies & names of the monethes according to the true Kalender lately calculated by a most excellent Mathematitian & mine old acquaintance M. Deos of Mortlake, as I coniecture by the letters I. D. set downe vpon the Horizon.

In the 12. are set downe the English names of the 32. Rombes of windes of the Mariners compasse.

In the 13. and outermost space are set downe the Latine names of the said 32. windes.

But the Mappe which couereth M. Molineux his Terrestrial Globe, differeth greatly from Mercator his terrestiall Globe, by reason that there are found out diuers new places aswell towards the North pole, as in the East & west Indies which were vnknown to Mercator. They differ also greatly in the names, Longitudes latitudes and distances of such places as haue beene heretofore set down not onely in Mercators globe, which was made many yeares since, but also in diuers Maps more lately made, but who goeth nigheſt the truth I dare not iudge, because I was neuer in those places. But as touching the map of stars which couereth the celestiall Globe of M. Molineux, I doe not finde it greatly to differ from that of Mercator, sauing that M. Molineux hath added to his celelestial Globe certaine Southerne images, as the crosse, the southerne Triangle, and certaine other stars, whereof some do signifie Noes Doue, & others doe signifie the image called Polophilax, the images whereof are not here set downe, but you shall finde them described in Plancius his Map, made in the yeare 1592. whose longitudes, latitudes, and declinations, how truely they

are

are ſet downe in the ſaid Globe or Map, I am not able to iudge. He ſetteth downe alſo two clouds nigh vnto the South pole, but not the vſe thereof. Moreouer to this briefe deſcription of M. Molineux his two Globes, I thought good to adde the firſt voyage of Sir Frances Drake, & of M. Thomas Candiſh, ſet forth by two lines, the one red, and the other blew deſcribed in the Terreſtriall Globe of the ſaid M. Molineux, and alſo how farre Sir Martin Furboſher ſailed Northward, as followeth.

The firſt voyage of Sir Frances Drake by Sea vnto the Weſt and Eaſt Indies both outward and homeward.

IN the grat terreſtriall Globe lately put forth by M. Sanderſon and by M. Molineux, the voyage aſwell of Sir Frances Drake, as of M. Thomas Candiſh is ſet downe, and ſhewed by helpe of two lines, the one red, & the other blew, whereof the red line proceeding firſt from Plymouth, doth ſhew what courſe Sir Frances obſerued in all his voyage, aſwel outward as homeward, and the blew line proceeding alſo from Plymouth, ſheweth in like manner the voyage of M. Candiſh, and in that Globe is alſo ſet downe how farre Sir Martine Furboſher diſcouered towardes the North parts. But firſt I will deſcribe vnto you the voyage of Sir Fr. Drake that worthy Knight and moſt noble Neptune, according as that red line directeth in the ſaid Globe.

Firſt parting from Plymouth he ſayled with a North North-eaſt winde to an Ile called Mogodore, vpon the coaſt of Marocco, which place is not named in M. Molineux his Globe, and that place hauing in North Latitude 32. degrées is diſtant from Plymouth according to that courſe, which the reede line ſheweth 420. leagues. In this Ile he built a little Pinnis or ſhallop, and from thence he ſayled to Cape Dalguere which is further Southward, and hauing in North Latitude 30. degrees, is diſtant from Mogodore about 40. leagues, and from thence he ſayled to the Ileſ Canariæ which are ſomewhat more Weſtward, and hauing 27. degrées 30'. in North Latitude, are diſtant from

the

the Cape Dalguere about 100. leagues, & from thence he sayled to Capo Blanco which is more Westernly, and hauing in North latitude 21. degrées, is distant from the Canaries 130. leagues & somewhat more, and from thence he sailed to the Iles of Capo Verde, which hauing in North latitude about 15. degrées, are distant from Capo Blanco about 140. leagues. And from thence to the great Cape of S. Augustine, which hauing in South latitude about 8 deg. is distant from Capo Verde 500. leagues, & from thence he sayled more Westernly vnto the mouth of the riuer called Rio de Platta, which hauing in South Latitude 36. degrées, is distant from Cape S. Augustine 760. leagues, & from thence to the Port Saint Iuliano, hauing in South latitude about 50. degrées, whereas one Doughtie was executed for conspiracie, and this Port is distant from Rio de Platta 370. leagues. And from thence he sayled to the Cape Virgine Maria, which hauing in South latitude 52. degrées 30. is distant from Port S. Iulian 50. leagues, and from thence striking in betwixt the Ile, whose Northeast Cape is called the Ile of the name of Iesus, and the Port Famine, he entred into the straight Magellane, which hauing in South Latitude 53. degrées 30. is distant from the Cape Virgine Maria 60. leagues, and from thence he passed through the Magellane straites to the Cape de Sancto spirito, which is a Cape of the South land, hauing in South latitude, 52. degrées 20. and is distant from Cape Virgine Maria about 160. leagues, from thence he sayled somewhat Westernly about 20. leagues, & there fetching a turne about certaine Ilands called Las Anegadas, he toke his course Northward alongst the West coast of America vnto the Ile Lima, which hauing in South latitude 12. degrées, is distant from the Ilands called Las Anegadas 840. leagues, and from thence he sayled still Northward vnto Cape Guiia, which hauing in South latitude 6. degrées 10. is distant from the Ile Lima 160. leagues, from thence still Northward he sayled to Cape S. Francesco, which hauing in North Latitude 1. degrée 30. minutes, is distant from Cape Guiia 170. leagues, from thence he sailed stil Northernly to the Cape Mondecimo, which is in the land called Quiaira, & this Cape hauing in North latitude 40. degrées is distant by that course from

S. Fran-

S. Franceſco 1740. leagues, from thence he ſayled ſtill Northward vnto a certaine Bay in the Weſt part of Quiuira, which he named Noua Albion (that is to ſay) new England hauing in North Latitude 46. degrées, and is diſtant from the Cape Mondecino 140. leagues. And this was the furtheſt part of his voyage outward, in which voyage he ſayled in all 5780. leagues, and from this Bay Sir Frances himſelfe (as I haue heard) was of very good will to haue ſayled ſtill more Northward, hoping to find paſſage through the narrow ſea Anian, which ſea is not ſet downe by M. Molineux in his Terreſtriall Globe as a ſtraight, but rather as a maine Sea, bearing in breadth 400. leagues, and ſo from thence to haue taken his courſe Northeaſt, and ſo to returne by the Iles Crocklande and Groynlande into England, but his Mariners finding the coaſt of Noua Albion to be very cold, had no good will to ſayle any further Northward, wherefore Sir Frances was faine to come backe againe Southward to Mondecino, which (as hath béene ſaid before) is diſtant from the foreſaid Bay of Noua Albion 140. leagues. From thence he ſayled in a manner right Southeaſt to the Iles Moluccas & touched at the Iles Terenate, Tidori, Machian, and Motill which are nigh vnto the Ile Gilolo, which is right vnder the Equinoctiall, amongeſt which Iles he remained a certaine time, of which Ilands the Ile called Terenate hauing about one degrée 30 of North Latitude, is diſtant by that courſe from the Cape Mondecino 1140. leag. and from thence he ſayled Southweſt vntill he came to the Weſt end of the Ile Iaua maior, which hauing in South Latitude nine degrées 30. minutes, is diſtant from the Ile Terenate by that courſe 620. leagues, and from thence he ſayled ſtill Southweſt to the Cape di Buona Speranza, which hauing in South Latitude 35. degrées, is diſtant from Iaua maior 1660. leagues, then from Capo di Buona Speranza he making his courſe Northweſt, ſailed to an Iland called Serra Liona, which is vpon the coaſt of Afrique, and hauing in North Latitude 7. degrées 30. is diſtant from Capo di Buona Speranza 1100. leagues, then from thence he ſayled towards the Iles of Capo verde vntill he came to the 12. degrée of North latitude right vnder the firſt Meridian, which point is diſtant from the Iſande Serra Liona according to that

course 320. leagues, and from thence he sayled Northward nigh to the Iles called Azores on the West side thereof, which hauing of North latitude 40. degrees are distant by that course from the Iles of Capo verde 600. leagues, from whence he directed his course Northeast to Plymouth, which hauing in North Latitude 51. degr. is distant by that course from the Azores 500 leagues so as in his returne from Noua Albion to Plymouth hee sayled in all 6080. leagues, which if you adde to the number of leagues of his outward voyage before set downe, which is 5780. leagues, you shall find the totall sum of the leagues to bee 11860. leagues which is almost twise so much as the compasse of the whole world which if you measure vpon the Globe by the Equinoctiall line containing 360. degrees, & doe allow for euery degree therof 60. Italian myles, you shall find the number of such myles to amount to 21600. myles, which by allowing three myles to a league doe make no more but 7200. leagues. But if it might please Sir Frances to write a perfect Diarie of his whole voyage, shewing how much he sayled in a day, and what watering places he found, and where he touched, and how long he rested in any place, & what good Ports and Hauens he found, & what anchorage good or bad, and what maner of people, what trade of liuing, and what kind of building and gouernment they vsed, as well in ciuil as in martiall affaires. Also in what aire they liued, and whether the ground were fertile or barren, dry or wel watered with floods & fountains, what mountains, what mines, what woods or forrests, what beasts fowles, or fishes, fruites, hearbes, plants, or other commodities he found therein, and in what manner of seas hee sayled, and what winds & currents were most rife in euery place: Also what rocks, sands, sholdes, and all other places of daunger and perill, and by what marks such places are to be shunned. And finally what Moon doth make a full sea in euery Port where he arriued & what winds doe alter any tide or Current, and all other necessarye accidents most meete for sea men to know. In thus doing the said Sir Frances I say should greatly profite his countrie men, and therby deserue immortall fame, of all which things, I doubt not but that he hath alreadye written, and will publish the same when he shall think most meete.

The

The voyage of M. Candiſh vnto the Weſt and Eaſt Indies, deſcribed on the Terreſtriall Globe by the blew line.



THis blewe line as you ſee taketh his beginning from Plymouth like as the redde line doth, whereby you may plainely ſee, that M. Candiſh did not greatly differ in his courſe from that which Sir Frances helde, ſauing that Maſter Candiſh hauing once paſſed the ſtraight Magellane Weſtward, ſayled not ſo farre Northward as Sir Frances did for hee ſayled no further Northwarde but to the Port Saint Lucas, which is almoſt vnder the Tropique of Cancer. for that Port hath in North Latitude 22. degrees 30. keeping alwaies a nigher courſe vnto the maine, then Sir Frances did, and from the Port S. Lucas he ſayled in a manner ſoutheaſt about 320. leag. and then he directed his courſe Eaſtward towardes the Moluccas & before he came to the Moluccas, he fetched about the Ile Catanaim, which is more Northward thē Sir Frances went in thoſe parts, and from thence hé ſayled full South to the Moluccas, from whence he directed his courſe Southweſt, & paſſed betwixt the Iles Iaua maior, and Iaua minor, which two Iles in the ſaid great Globe are made to haue one ſelfe Latitude (that is to ſay) about 10. degr. of South Latitude, counting frō the Equinoctiall to ẏ Parallel which paſſeth through both the Iles. But in all other globes & Maps Iaua minor ſtandeth 10. degr more to the South & is placed behind the ſouth promontory called the land of Beach. Then hauing paſſed betwixt the foreſaid 2. Iles, he helde in a maner the like courſe ẏ S. Frances did in his returne to Plimouth, which ẏ blew line doth ſhew ſo plainely as it nédeth none other deſcriptiō. Now as touching S. Martin Forbuſhers voyage, becauſe his own deſcriptiō thereof is in print, nothing is ſet downe in this globe, but only ẏ outermoſt end of his voyage named here Furboſhers ſtraights, hauing in North latitude about 63. degrees, in the mouth of which ſtraights is a little Iland called Hales Iland on

the right hand, and on the left hand another little long Iland called Leceſters point. Truely this knight for his valourous venter, aſwell in this voyage as in diuers other his worthy ſeruices done vpon the ſea deſerueth great commendation, and I wiſh with all my heart that he and ſuch like might bee much made of, and rewarded according to their deſert. And thus I leaue to ſpeake any further of M. Molineux his Globes, the vſe whereof is to be learned by thoſe Propoſitions which I haue heeretofore ſet downe, ſhewing the vſe of Mercator his two Globes, for the practiſe and manner of working both by his Globes and by theſe Globes is all one.

A plaine and full deſcription of *Petrus Plancius* his vniuerſall Map,

ſeruing both for ſea and land, and by him lately put foorth in the yeare of our Lord, 1592.

In which Mappe are ſet downe many more places, aſwell of both the Indies as of Afrique, together with their true Longitudes and Latitudes then are to be found either in *Mercator* his Mappe, or in any other moderne Map whatſoeuer, and this Map doth ſhew what riches, power or commodities, as what kindes of beaſtes both wilde and tame, what plants, fruits, or mines any Region hath, and what kinds of marchandizes do come from euery Region.

Alſo the diuers qualities and māners of the people, and to *whom they are ſubiect. Alſo who be the moſt mightie & greateſt* Princes of the world: A Mappe meete to adorne the houſe of any Gentleman or Marchant that delighteth in Geographie, and therewith this Booke is alſo meete to be bought, for that it plainly expoundeth euery thing contained in the ſaid Mappe.

Written in our mother tongue by M. *Blundeuill*

Anno Domini. 1594.

Imprinted at London by *Iohn Windet.*

IN DOCTISSIMI VEREQVE GENEROSISSIMI VIRI *THO. BLVNDEVILI* IN *PETRI PLANCII* TABVLAM GEOGRAPHICAM ET HYDROGRAPHICAM ELVcidationes, *Gualteri Hawghi*

Δεκατετράστιχον

PLancius in tabula terras descripsit & vndas,
Quæcunqne & toto condidit orbe Deus:
Multiplices horum partes, Regumque per illas
Sceptra superba, simul totius orbis opes.
Sed solis Gallis hæc Plancius, atque Latinis,
Inter & hos, Doctis scripserat, haud aliis,
Tu Generose tuis patrio hæc Idiomate clare,
Blundeuile refers, Cunctaque nota facis.
Tu simul hæc auges, lucemque his addis & horum
Vsum, multiplici non sine fruge doces.
Nec solum doctis, sed & omnibus hæc Idiotis:
Perspicua vt pateant, tu breuitate facis.
Plancius hæc aliis, tu nobis omnia tradis,
Tuque tuis Anglis Plancius alter eris.



A plaine and ful deſcription of Plancius *his vniuerſall* Mappe, *ſet foorth in* the yeare of our Lord, 1592. written in our mother tongue by *M. Blundeuil.*

IN this Mappe, as you ſee, are drawn with redde Inke two lines or Diameters croſſing one another with right Angles in the very midſt of the Mappe, whereof the perpendicular Diameter paſſing through the Iles Azores, and alſo through the Iles of Capo verde, ſignifie the firſt Meridian and Arletree of the world, at the vpper end whereof is ſet the North pole, and at the neither end the South pole. And the other ouerthwart Diameter ſignifieth the Equinoctiall, and alſo the line of Eaſt and Weſt, that is to ſay, Eaſt on the right hand, and Weſt on the left hand. And in this line are ſet downe the degrees of Longitude, which are to bee counted from the foreſaide firſt Meridian vpon the ſaid Equinoctiall towardes your right hande from one degree to 180. ſet downe in Arithmeticall figures thus, 10. 20. 30. and ſo foorth vntill you come to 180. which is the Eaſt Longitude of the world, and the Weſt Longitude beginneth on your left hande whereas is ſet downe 190. and then 200. and ſo foorth vntill you come to 360. degrees, which is the whole circuit of the Equinoctiall, and of the whole earth. And in the firſt Meridian are ſet downe the degrees of Latitude, which doe proceede from the Equinoctiall to

eyther of the Poles from one degree to 90. written in Arithmeticall figures thus, 5. 10. 15. and so forth to 90. which degrees doe proceede with equall distances from the Equinoctiall to eyther Pole, and the like degrees of Latitude are also set downe vpon the two outermost Meridians, as well on the right hand as on the left. And on each side of the Equinoctiall are drawn with redde inke the two Tropiques, that is to say, the Tropique of Cancer, and the Tropique of Capricorne, each one being distant from the Equinoctial 23. degrees 28. which is the greatest declination of the Sunne, and towards each pole are also drawne with redde inke the two Circles both Arctique & Antarctique, whereof the circle Arctique passeth through the Northernly part of Island hauing in Latitude 66. degrees 30. and the Circle antarctique passeth through the like degrees of Latitude towards the South pole, and the distance of each of those Circles from either pole is equall to the greatest declination of the Sunne. And these foure Circles are Parallels to the Equinoctiall, bounding the 5. Zones that is, the two cold the two temperate, & the hotte Zone which lyeth in the midst of the world betwixt the two Tropiques. And on the left hand or West part of the Pappe are set downe from the Equinoctiall vpward towards the North pole, what number of miles and seconds of miles doe belong to euery degree of the North Latitude, proceeding from the Equinoctiall towards the North pole: for though that euery degree of the Equinoctiall being a great Circle contayneth 60. miles, yet the further that you goe from the Equinoctiall towardes either of the Poles, the lesser and lesser are your Parallel Circles in compasse, and therefore one degree of euery such Parallel must needes containe the fewer miles, but because the sea men doe commonly make their account on the sea by leagues and not by miles: Plancius here right vnder the former Table of miles, setteth downe the number of leagues incident to euery degree or Parallel, in descending from the Equinoctiall to the South pole, appointing three miles to a league, and therefore he setteth downe vppon the very Equinoctiall 20. leagues, which is 60. miles, and next to that he setteth downe 19 leagues 59. and so proceedeth forth diminishing still the quantitie of the leagues, euen till you come to the very South pole and

on

on the right hand of the Map hard by the outermoſt Meridian are ſet downe the nine climes, and the longeſt day in euery degree of latitude, proceeding aſwell from the Equinoctiall to the North pole, as alſo from the Equinoctiall to the South pole, from 12. houres to 187. dayes and 7. houres, which maketh the longeſt day to thoſe that dwell right vnder the North Pole, to be halfe a yeare and the night aſmuch. Beſides the Circles and lines before mentioned, there are ſet downe in this Mappe certaine flies of the Mariners compaſſe, each one containing two and thirtie lines, which doe ſignifie the two and thirtie rombes or winds of the Mariners Compaſſe to knowe thereby how one place beareth from another, and by what winde the Mariner hath to ſayle to any place whereunto he would goe: In euery which fly the line of North and South may ſerue in ſtead of a Meridian, and the line of Eaſt and Weſt may ſerue as a Parallel, by helpe whereof you may the more readily take with your Compaſſes the Longitude and latitude of any place contayned in the Mappe in ſuch manner as is taught in my firſt Treatiſe of Vniuerſall Mappes. Alſo in the verie front of his Mappe hee ſetteth downe the numbers of foure and twenty houres, euery houre containing fifteene degrees of the Equinoctiall, which houres doe beginne on the right hande, and ſo proceede to the left, whereof the twelfth houre is placed at the ende of that Meridian which paſſeth through the Fortunate Iles. Now betwixt the 72. and 86. degrees of North latitude he ſetteth downe two long Ilands extending from the Weſt towardes the Eaſt ſomewhat beyond the firſt Meridian, and from the ſaide Meridian more Eaſtward he ſetteth downe other two long Ilandes, affirming that the North Ocean ſea breaking in betwixt theſe Ilands with nineteene gates or entrances, maketh foure ſtraites and is continually carryed vnder the North Pole, and there is ſwallowed vp in the bowels of the earth, and hee ſaith further that right vnder the North pole there is a certaine blacke and moſt high rocke which hath in circuite thirtie and three leagues, which is nintie and nine miles, and that the long Iland next to the Pole on the Weſt is the beſt and moſt healthfull of all the North parts. Next to the foreſaide Ilandes more Southward

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hee setteth downe the Ilandes of Crocklande and Gropnelande, making them to haue a farre longer and more slender shape then all other mappes doe: At the East ende of the thirde long Ilande, is a straite hauing fiue gates or entrances, which by reason of their narrownesse and swift course of streame are neuer frozen, if this be true, I meruayle how any shippe durst enter through any of those straightes to discouer the North sides of any of those Ilandes, and how and where it came out againe, Moreouer at the East ende of the last Ilande somewhat to the Southwarde, he placeth the Pole of the Lodestone which is called in Latine Magnes, euen as Mercator doth in his Mappe who supposing the first Meridian to passe through Saint Marie or Saint Michael, which are two of the outermost Ilandes of the Azores Eastwarde, placeth the Pole of the stone in the seuentie fiue degree of Latitude, but supposing the first Meridian to passe through the Ile Coruo, which is the furthest Ile of the Azores Westwarde, he placeth the Pole of the Lodestone in the seuentie seuen degree of Latitude. I thought good to seuer the Ilandes last before mentioned from the bodie of the Map as partes belonging rather to the North Pole, then to *Europe*, Asia, Africa, or America: for if Virgill did not let to say that Englande was Penitus excluſa ab orbe, mee thinkes that I may much more rightly say the like of these Ilandes, notwithstanding Plancius maketh the first two long Ilandes and also Gropnelande and Crockelande to bee part of Mexicana, which mee thinkes is not meete, sith they bee deuided by the North Sea, likewise he maketh the land which is vnder the South Pole, and is not as yet discouered, to bee parte of Magellanica, which (in mine opinion) ought not to bee so, sith it is not onely deuided from Magellanica, by the straight Magellanicum, but also from Afrique and from the East Indies by the great Moutherne Ocean, and I beleeue that when the Southlande shall bee all discouered, it will containe twice so much land as Magellanica doth, and then I doubt not but that the Geographers will giue it some other name, and make many diuisions thereof: In the meane time I will follow Plancius his owne diuision of the worlde, which greatly differeth from that

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of Mercator, and of all other moderne Geographers, for they doe deuide the whole earth but into foure parts, that is to say Europe Afrique Asia and America, but plancius by deuiding America into three parts, that is, into Mexicana, Peruana & Magellanica deuideth the whole earth into fiue parts, that is to say, Europe, Asia, Afrique, and into ꝑ three partes of America last mentioned, according to which diuision, hee describeth the earth in the french tongue in sixteene pages, set downe at the foote of his Map the foure last pages whereof doe onely containe the interpretation of the seuentie & one litle Tables or Inscriptions written in the Latine tongue, dispersed throughout the whole Mappe, expressing therein such thinges as hee thought most meete to bee noted in diuers partes of the worlde, all which Tables or inscriptions, I haue heere also set downe in our mother tongue: And although that to the foresaid Tables or Inscriptions Plancius hath attributed certaine numbers for the more easie finding out of the said inscriptions, yet not easie enough by reason that one selfe number is set downe in diuers Tables, and therefore to the intent that you might the more readily finde out euery Table that is proper to the matter whereof it maketh mention, I haue heere following ioyned to the number of euery such Table his proper Longitude and Latitude, which with your Compasse you may quickly finde out, and more certainly, then by his numbers, if you remember the order thereof set downe in my treatise of vniuersall Mappes. But now I will declare the contents of the foresaide sixteene pages in order as followeth.

The

The title of The firſt page is thus.

A brieſe declaration of the diuiſion, forme or ſhape, *and of the particularities of the world.*

The Contents of the firſt page.

That the earth and the water doe make both together one round body, which the Coſmographers do inuiron with fiue Circles, that is ỳ Equinoctial, the two Tropiques, and the two Polar Circles, and thereby do deuide ỳ worlde into fiue Zones, two cold, two temperate, and one extreame hot: and though that the auncient Geographers do affirme that thꝛée of thoſe Zones were vnhabitable, the one foꝛ extremitie of heat, and the other two foꝛ extremity of cold, yet within theſe hundꝛed yeares laſt paſt it is knowne by good experiẽce that thoſe thꝛée Zones are well inhabited as the manifold Countries therein placed and greatly repleniſhed with people of ſundꝛy languages doe well teſtifie, of allwhich things I haue written at large inmy Spheare. And thereforꝛe I make this page the ſhoꝛter.

The Contents of the ſecond page.

TO know the true ſituation of the Pꝛouinces and places contained in this Mappe, it is neceſſarie firſt to know their Longitudes and Latitudes. The degrees of Latitude oꝛ of the eleuation of the Pole, which is all one thing, are counted from the Equinoctiall to either Pole, which is 90. degrées, and the degrées of Longitude are counted vpon the Equinoctiall from the Iles of Capo Verde towardes the Eaſt, and ſo round about the earth vntill you come to the number of 360. degrées. The Pꝛouinces and Townes that are

ſituated

ſituated vnder one degree of Longitude, haue at one ſelfe time like houres of the day, but thoſe that are ſituate vnder diuers degrees of longitude, doe differ in number of houres, for when it is in one Towne noonetide, it is in another Towne that is diſtant from thence towardes the Eaſt 30. degrees, two of the cloche in the afternoone, and ſo conſequently for euery 15. degree of diſtance they differ an houre. Likewiſe they that dwell vnder one ſelf degree of latitude haue equall quantitie of dayes and nights, but yet ſo as they which dwell on the South ſide of the Equinoctiall haue the ſhorteſt day when wee haue the longeſt, and haue Winter when we haue Sunnmer. But thoſe that are ſituate vnder diuers degrees of latitude, haue inequalitie of dayes and nightes, for the nigher that any place is ſituate towards any of the Poles the more houres the longeſt day of the yeare in that place containeth, But thoſe that dwell right vnder the Equinoctiall haue alwaies their dayes and nightes of like quantitie, and I vnderſtand heere by the day, the ſpace betwirt the Sunne riſe and the Sunne ſet, and you ſhal find the quantitie of the longeſt day of the yeare in euery degree of latitude ſet downe in the Northeaſt part of this Carde. As for example, to thoſe that haue 30. degrees of latitude, the longeſt day is 13. houres 57. and ſo the nigher that you go to the Pole the longer is the day, in ſo much as thoſe that dwell right vnder the Pole, the yeare is but a day and a night, that is to ſay, they haue 6. monethes day, & 6. moneths night Moreouer the Geographers do deuide ỳ earth into 9. clymes for to diſtinguiſh thereby the prouinces & regions by the quantitie of the longeſt day, the middle moſt parallel of euery clime increaſing by halfe an houre and you haue to conſider that the degrees of latitude are in al places of like bignes euery degree contayning 15. Almain leagues, or 60. Italian miles, but the degrees of longitude proceeding from the Equinoctiall towards any of the 2. Poles are vnequall, that is to ſay, euerie one contayning fewer leagues or miles then other, but the degrees of the Equinoctiall it ſelfe are equall to the degrees of latitude, euery one contayning 15. Germaine leagues or 60. Italian miles, as you may plainely ſee in the Table ſet downe in the Northeaſt part of this Map. And you haue to note that one Almaine

main league doth containe 4. Italian miles, and we haue deſcribed the degree of longitude in the Southweſt part of this Carde by the houres of the ſhips way, euery one decreaſing leſſe then other from the Equinoctiall to the Pole, whereby you may conceyue that two ſhips being right vnder the Equinoctiall 150. degrees diſtant one from another, and are to ſayle with like gate towardes the North pole: when they ſhall come to the 60. degree of latitude, their diſtance ſhall be no more but 75. leagues. And the further they go towardes the Pole the leſſe diſtance they ſhall be one from another, in ſo much as when they bee right vnder the Pole it ſelfe, they ſhall both meete, as you may ſee in the 2. round figures containing the deſcription of the earth, and ſet downe in the 2. nether corners of the Mappe. This matter is to bee conſidered of the Marriners, that they may thereby the better perceiue the imperfections of their ſea Cardes. Moreouer, in the ſecond page Plancius ſetteth downe the diuiſion of the earth as wela ccording to the auncient as moderne Geographers, making firſt three generall continents or firme landes, whereof the firſt is ſo much as was knowne to Ptolomey and to the auncient Aſtronomers, as Europe, Afrique, and Aſia, the ſeconde continent is called America, and the third continent is the South part of the world, not yet fully diſcouered, called of Plancius Magellanica, and he deuideth the ſecond continent called America into three partes, that is, Mexicana, Peruana, and Magellanica and by adding thoſe three parts to Europe, Afrique and Aſia, he diuideth the earth into fiue partes, and firſt hee ſetteth downe the deſcription of Europe together with her bounds or limits, and then the commodities thereof, as followeth.

Of Europe.

EVroPe is farre leſſe than all the reſt, and yet exceedeth all others in nobleneſſe, in magnificence, in multitude of people, in might, puiſſance, and renowne the which in times paſt hath commaunded both Aſia and Afrique as Lucene, by reaſon of the Monarches of the Greeks and of the Romaines, and at this day is of great force by the power of the Turks and Muſcouites

uites. Moreouer it commaundeth many prouinces in Mexicana and Peruana by the power of the Spaniards and Portugalles, and of other Christian Princes.

Europe is seuered from Asia & Africque by the sea Mediterraneum, and by the sea called Mare maior, and by the Pariſh or sea called palus Meotis, and by the Flood Tanais & Dwina. The chiefest prouinces of Europe are these Almanie, Italie, France, Spaine, Denmarke, Norway, Swethland, Muscouia, Polonia, Hungaria, Sclauonia and Greece. The chiefest Ilandes of Europe are these England with Scotland, Ireland, Sardinia, Corſica, Sicilia, Candia, Nigro Ponte sometime called Euboia and Stalimine, sometime called Lemnos. And in this second page hee setteth downe also the description of Almanie thus.

Almanie is reputed to bee the greatest prouince in all Europe, and is situated in the middest thereof, which is bounded on the East with Polonia and Hungaria, on the South with Dalmacia, and Italia, and on the West with Fraunce, and on the North with the North Sea, and with the Sea called Mare Balticum. The inhabitantes of this Countrey warred in olde time with the Romaines for their libertie, and since many hundred yeares past it hath holden the imperiall Scepter. About the time of Christ his birth, it was a rude Countrey, as Cornelius Tacitus saith, full of Wood, bushes, and Marishes but at this day it is so adorned with great magnificent Townes and well fortified, and is furnished with such a number of Castles, and Villages, and with such a number of people, and with such politique gouernment, as it is to bee compared to any prouince whatsoeuer in all the worlde. The soyle thereof is very fruitfull both for Corne and Wine, and hath many nauigable Floods stored with plentie of Fish. It hath most excellent fountaines and hotte Bathes, great Mines of Golde, of Siluer, Copper Tinne, Lead and Iron. The inhabitantes doe exercise as wel now as they haue done in times past the Arte military, and it hath many learned men very skilfull in all sciences, and in mechanicall arts, they were the inuenters of Artillerie, of Gunpowder, and of the noble art of printing, and of making artificial Dials and horologies.

The

The chiefe merchandizes that are tranſported out of Almanie into other Countries are theſe, Golde, Siluer, Copper, Tinne, Leade, vitriol, Allum, Quickeſiluer, Colours of diuers ſortes, Slates to couer houſes, Wheate, Wine, Fiſh, Woollen cloath, Linnen cloath, Bombaſine, Fuſtian, Saile, Armour, all ſortes of workes made of Iron, or Braſſe, and other mercaries.

The contents of the third page.

IN the third Page he deſcribeth the 17. Prouinces of the lowe Countries, alſo Italie, France, Spaine, and Denmarke, as followeth.

THe 17. Prouinces of the lowe Countries are counted a part of Almanie, by reaſon that the moſt part of the inhabitants haue as well their originall as their language from the Almaines. But thoſe of Artoys, of Henough Namures, and part of the inhabitantes of Brabant, Flaunders, Lymburgh, and Liezenburgh doe ſpeake the French tongue. Theſe Prouinces are ſituated partly within the ancient limits of Almanie, that is to ſay, beyond the Orient all part of the floud Rhenus, & partly in Gallia Belgica, as alſo are the Prouinces of the 4. Princes electors and of many other Prouinces of the Empire. In theſe Prouinces are many nauigable Floods & rich in fiſh, namely the Rheane, Moſella, Moſa, and the Eſcaut, and there is great aboundance of all ſortes of Corne and Cattell meete for mans vſe, there is alſo a number of great Townes, rich, mightie, and well peopliſhed, alſo of fortreſſes well fortified, faire villages, but chiefly of braue and commodious portes and hauens, and an incredible number of ſhippes, and the continuall warres that they haue had and haue at this day doe witneſſe to all the world their great force, might, and riches. The inhabitants in time of the Romain Monarchie were and alſo are at this preſent greatly renowmed for their ſkill in the arte militarie, and beſides that, they are moſt excellent and induſtrious in all ſciences and mechanicall artes, and they haue a great number of Mariners

and

and Pilots well practised in the arte of Nauigation, and to these Prouinces is attributed the inuention of the Mariners Compasse, according to the opinion of many learned men, which truely is one of the noblest inuentions that euer was found out since the world beganne. In the towne of Burghesse was inuenced the Arte of Painting with Collours tempered with Oyle

The Prouinces of Belgia doe sende vnto other Prouinces all sortes of Cloathes made of Woll and Flaxe, linnen cloath of Cambria. Skarlets enterlaced with Golde, Siluer and Silke, Taffetas, Bozattas, Grograines, single Buffen, Saies of Leyden and Howscot, Worsteds, and halfe Worsteds, Fustianapes of Veslures, and of Woll, Bayes, silk, parchment lace Sarcenet and inkle, all manner of twisted threed, silke ready dresst purified Sugar, Buffe, Shamoyes, striped Marokines, painted Pictures, Bookes, Armour, Cables, Ropes, and other Munitions belonging to Shippes, Knives, Pinnes, and all sortes of Mercerie or Haberdash ware, and Fish dried and salted

ITaly being the mother of eloquence and of all Latine erudition doth extend it selfe like an arme towards the Southeast, lying betwixt the Tuscane sea and the gulfe of Venice, and is bounded on the west part with France & on the north part with Almanie being seperated from the said two Prouinces by the Flood Varo and the Alpes, and all the rest is mured with the sea at the time of the nativitie of Christ and since, she most flourished, being adorned with the fourth Monarchie, and with the most mightie towne of Rome, which at that time was Quæne of many prouinces of Europe, Asia, and Afrique, which citie in the time of the Emperour Vespasian, had in circuit 13. Italian miles and 200. paces, as Plinie writeth in his third booke and fift chapter Clauius Vopiscus reciteth that this towne was inlarged by the Emperour Aurelius to 30. Italian miles, which is 10 houres of way or gate, allowing three myles for an houre. This Prouince hath brought foorth, as it doth at this present, inhabitants of great industrie and wit, and it containeth many noble Cities

and of great renowme, as Rome, which hath bene ſometime the head of the world, Venice the rich, Rauenna the ancient, Naples the gentle, Florence the beautifull, Genua the proud, and Millaine the great. In a towne called Amalphe ſituate vpon the Sea, betwixt Naples and Salerno, the Mariners Compaſſe was inuented in the yeare 1300. according to the opinion of ſome, by one Iohn Goia, citizen of the ſame towne: notwithſtanding Iohn Gorop Becanus doth attribute that inuention to Flanders which ſeemeth the more likely, for ſo much as all the Pilates & Mariners of France and Spaine and other places doe name the 32. windes or rombes of the Compaſſe by the Belgicke names. The chiefe merchandizes that are ſent out of Italie into other countries are theſe, Rice, Silke, Veluet, Satten, Taffatas, fine peces of Linnen, Grograines, Raſh, Stamin, Bombaſins, Fuſtians, Feltes to make riding cloakes, plentie of rich armour, Wiar of golde and ſiluer, Allum, Galles, drinking glaſſes and looking glaſſes of Venice

FRance hath bene alwaies eſteemed to be the chiefeſt Realme of all Europe, whoſe ſoyle is moſt fertile, and bringeth forth all kind of Graine, and euery other thing that is neceſſarie for mans ſuſtenance, there is great ſtore of wine, and great plentie thereof is diſtributed to other Prouinces nigh adioyning. The Prouince doth abound in oyle Oliue, and in Corall, and in many other noble fruites. In France are many great townes well walled, as Paris, Roan, Amiens Orliens, Toures, Nantes, Poictiers, Burghes, Tholous, Lyon, Narbona, and Marcelles. It hath 15. Archbiſhoprickes, and 108. Biſhoprickes, and a great number of townes and villages, and 132000. pariſhes, it is greatly peopled, and hath not ſuch deſerts or heathes as are in other Prouinces of Europe, the French men haue bene, and are at this preſent renowmed in the Arte militare, and there be many learned men in all facultes and ſciences.

The chiefe Merchandiſes that are carried out of France into other prouinces are theſe, Wheat, Rie, Beſes, Hogges, Swine, and other cattell, Salt, wines, wild Oliue, Cheſnuts, Almonds, Prunes, Corrall, Diars wadde, Clothes, linnen, Canuas and Skinnes.

Skinnes.

SPaine is inuironed rounde about with the Sea, sauing that on one side it is seperated from Fraunce by the Mountaines Perenei. This countrey was sometime diuided into three Prouinces or Kingdomes, that is, Taraconensis, Lusitania, and Betica, but now it is subdiuided into many Realmes, that is to say, Castilia, Aragon, Portugall, Gallicea, Lyon, Nauarra, Toledo, Valentia, Murcia, Granado, Cordoa, and Algarbia, the which Realmes if they had beene reduced to one body of a Realme as France is, and as they be at this houre subiect to one onely king and Lord, it should be without doubte one of the most mighty and puissant kingdomes of Europe. The inhabitants of Spaine haue beene and are at this present much renowmed in the Arte militare, and in feates of warre, & it hath brought forth in times past many great Clearkes, as Seneca, Quintilian, Lucan and Martial, and in our time it had Iohannes, Ludouicus Viues, Iohannes Osorius, and Benedictus Arias Montanus. The Prouinces of Spaine are become very rich and mightie, by reason of their nauigation into America, Africa, Arabia, Persia, India, the Iles Moluccas and China, in wich Prouinces (China excepted) the king of Spaine possesseth many countries that bee rich and of great power, and many townes and fortresses in a manner round about the earth.

The chiefe Marchandizes that grow in Spaine, and are carried into other Countries are these, wines, Oyles, Rice, all sortes of fruites of Spaine, Liquoras, Silke, great quantitie of Woll, Lambe skinnes, Corke, Rosin, Steele, Iron and Armour.

DEnmarke and Norway are very great Regions, and are as large as the countries of Almanie, bordering vpon Almanie towardes the South, they extend towardes the North to 71. degrees 30′. of North latitude, and towardes the East they border vpon Swethland, and on the West and North side they are inuironed with the Sea. These two Realmes are at this day vnder the gouerment of one onely king, who also is Lorde of Islande and of the Iles of Fero, Hitland, and Gothlande.

Iuthland was sometime the habitation of the Cimbres, who in times past made cruell warres against the Romaines.

The Marchandizes sent from the two forelaid realmes into other prouinces are these, Oren, Barly, Malt, stockfish, tallowe, nuts and Filbirds, hydes of Oxen, and Bucke skins, Pastes for ships, plancks and the tops of Wainscot, Solues, and fire wood to burne, pitch and Tar, Sulphur and such other things.

The Contents of the 4. page, wherein he describeth *Swethland, Polonia, Hungaria, Sclauonia, Greece, England, & Scotland* as followeth.

SWethland is a great and mightie realme, bordering towards the East vpon Russia, and towards the South vpon the East sea, called Mare Balticum, diuiding Swethland from Almany and Pomernia, and towards the west vpon Norway and Denmarke, and towardes the North vpon Finmarke. Stockholme is the Metropolitane citie in this realme, wherein the king keepeth his court. From this realme is transported into other prouinces these Merchandizes, that is to say, Copper, Iron, lead costly Furres, hydes or skinnes of Elkes, of Oxen, of Buckes, of goates, tallow, tar, barly, malt, nuts & Filbirds, and such like

The description of Muscouia which should follow next, is set downe in the third table or inscription, which standeth in the very front of the table, written in Latine, the interpretation whereof hereafter followeth in his place.

THe kingdome of Polonia containeth Lituania, Podolia, the lesser Russia, Volhinia, Massouia, Samogitia, Prussia & in a manner al Liuonia, which two last Prouinces did belong not long since to Almania. Polonia is bounded on the East with Muscouia and with the Tartaries perocopsiques, and on the South with Moldauia, and Hungaria, and towardes the West with Almania, and towardes the North with the sea, Baltique and Muscouia.

The

The chiefe merchandizes that go out of this realme into other Prouinces are these, Wheat Rie, and other graine, Sturse or Danske Beare, yellow Amber, Waxe, Hony, a certaine drinke made of Hony which wee call Meade, hydes of Oxen dryed and salted, Flaxe, Hempe, Pitch, and Tarre, Ashes, Clauell es, wood Frazier, and of Cuvelier, and other such like merchandizes.

HVngarie is a very fruitfull Realme, rich and mightie, and it is bounded on the East with Moldauia, and Valachia, and on the South with Bosnia and Croatia, and on the west with Almania, and on the North with Polonia it hath many nauigable Riuers, wherein are great store of fish, that is to say, Danubius, Dravus, Savus, and Tibiscus. The chiefe townes are these Buda, Gran, Weissenburgh, Rab, Prezburgh, Agria, Colocza, and Belgrada. The inhabitantes of this countrey are warlike and hardie, and haue beene long time heretofore a most faithfull Rampire and bulwarke to all Christendome, but in the end by reason of their ciuill warres, the better part of them haue beene subdued in our time, and are made most miserable slaues to the Turke.

The Marchandizes which goe out of Hungarie into other Prouinces are these, Golde, Siluer, Copper, and diuers sorts of Collours, Salt, Wine, Wheat, Bées, and fresh fish of the riuer salted.

SClauonie is bounded on the East with Bulgaria, and Greece, and on the Southside with the Gulfe of Venice, and on the West, with the North part of Italie, and on the Northside with Almanie and Hungarie. This region contayneth many particular Prouinces as Liburnia, Croatia, Bosna, and Dalmatia, the chiefe Townes whereof are these, Raguza, Salona, Sabenica, and Zara. Sclauonie at this time is diuided into many iurisdictions, for one great part thereof is subiect to the Turke, another part to the Emperour of Almany, and the rest situated vpon the sea coast is subiect to the Seniorie of Venice. At this day there is no tongue (the Arabie tongue excepted) that extendeth further than the Sclauonie tongue, for

as it is the Vulgar tongue of Sclauonie, ſo is it familiar to them of Hiſtria, Bohemia, Morauia, Seleucia, Polonia, and to the large Prouinces of the great Duke of Muſcouia, Circaſsia, Perihoka, Georgiana, Mengrelia, Moldauia, Valachia, Bulgaria, Ruſsia, Seruia, Albania, and to part of Hungarie, it is alſo familiar in the Court of the great Turke, & among his ſouldiers that ſerue in Aſia and Afrique.

GReece ſometime the mother of all ſcience and erudition, is on the Eaſt, South and Weſt ſide inuironed with the ſea, but on the Noꝛth ſide it is bounded with Seruia and Bulgaria, it hath in times paſt valiantly fought with and beaten the Monarchie of Perſia foꝛ the libertie of their countrie, and finally by Alexander the great hath triumphed ouer the ſame, and thereby erected the third Monarchie, by meanes whereof it came to paſſe that the Greeke tongue was made common throughout Aſia, Syria, and AEgypt, vntill ſuch time as the Saracens & the great Turke did coꝛrupt and change the ſame. The Emperours did rule in Greece from the time of Conſtantine the great vnto the yeare 1452. in which yeare Mahomet the great Turke foꝛced the towne of Conſtantinople, and aboliſhed the Empire of Greece in ſuch ſoꝛt as euer ſince this magnificent and ſtrong imperiall towne of the Chriſtians, hath beene the ſeate of the Empetour of Turkie, and all the countrey made ſlaues to the Mahometanes.

The chiefe Marchandizes that come from this Countrey to other Prouinces are theſe, Gold, Siluer, Copper, Vitriall, diuers ſoꝛts of collours, wines, Oyle, Velues, Damaſke, Grograines, Turqueſques and Wood.

ENgland together with Scotland making both but one Iland is the greateſt and mightieſt of all Europe. And England is enuironed on all ſides with the ſea, ſauing on the Noꝛth ſide, which boꝛdereth vpon Scotland. The aire according to the ſituation is indifferent temperate, foꝛ though it be moꝛe Noꝛthward than Flaunders, yet it is not ſubiect to ſuch hard frokes and colde winters. The ſoyle is very fruitfull, bringeth foꝛth great plenty of Wheate and of other Coꝛne, it hath great plentie

of

of fruite trees, and there bee many large and faire woods, sweete fountaines, floods and riuers full of fish, and a number of good hauens, also it hath many rich Mines, as of Golde, Siluer, Lead, Iron, and chiefely of fine Tinne, wherefore it may bee worthily counted amongst the most puissant & richest Ilands of the world. This Iland nourisheth also a great number of cattell meete for mans vse, and chiefly of sheepe, which yeeldeth fine and good wool, in which, partly consisteth the profite and riches of the country, in such sort, as the Golden Fleece ought to haue beene sought for in this Ilande, and not at Colchos. the inhabitants most commonly are tall of stature, beautifull and white of visage, courageous and meete for the warre, also they are ingenious and studious in the Arte of Nauigation, in so much as in these dayes they haue traffique into very farre countries, as into Greece, Natolia, Syria, AEgypt, Barbarie, Muscouia, and into many other prouinces. London being situated vpon the Thames is the Metropolitan and chiefe towne of this Realme, and the Staple of the trade of Marchandizes, and the Courte royall. but Cambridge and Oxforde are Vniuersities.

The Merchandizes sent from Englande into other prouinces are these, broade Cloathes, Carsies, Stammes, Bayes, Sayes, Saffron, Tin, Leade, Wheate, Barley, Malte, Beere, red Herringe, sea cole, and woode.

SCotland is the North parte of this Iland, and is likewise inuironed round about with the sea, sauing on that side with which it bordereth vpon Englande. This Countrey is not so fruitfull as Englande, notwithstanding it is sufficiently prouided of all things that is needfull for mans nutriment, it is watred with diuers armes of the Sea, and is indued with many mountaines full of grasse, which seruеth to feede their cattle. Edenburgh is the Metropolitaine of this realme, wherein the K. keepeth his court. The Scottishmen are good Souldiers, which can endure scarsitie and the iniuries of the aire, and are very desirous to win honour. The inhabitants of the South part thereof doe speake the English tongue: but those of the North, and those of the Iles Hebrides doe vse the Irish tongue, and those of the

Orcades do vſe the Northway tongue.

The Merchandiſes which Scotland ſendeth to othe countries are theſe, courſe clothes, Karſies, Stamins, Freeſes, Wool, Barlie, Malt, Fiſh, Hydes, leaden Owze, and Smithes cole.

The contents of the firſt page.

IN this page he deſcribeth Irelande, the Iles Azores, Corſica, Sardinia, Sicilia, Candia, nigro Ponte, Stalimine, all which Ilandes doe belong to Europe, and in the later end of this page hee beginneth to diſcribe Aſia.

IReland is nigh vnto England and Scotland, and is very rich in meddow ground, and hath great plentie of cattell as well tame as wilde, and fiſh as well of the ſea, as of freſh riuers, and great quantitie of foule and birds, but it hath ſcarcitie of corne by reaſon of the great moyſtneſſe of the ayre. This Ile is free from all venemous beaſtes, the inhabitantes are wilde people, great and ſtrong, ſwift in running, and by little and little they ware euery day tamer then other, vnder the gouernement of the Engliſh men.

THe Iles of Azores are called of the Flemiſh Pilots & Mariners the Flemiſh Iles, becauſe thoſe of Bruges were the firſt that diſcouered thoſe Ilandes, & albeit that at this preſent the inhabitantes thereof are Portugalles, there is yet a remnant of Flemiſh families, as of the Bruines, of the Vltrickes and others Theſe Iles are fruitfull, and bee 9. in number, that is to ſay, the Iles of S. Marie S. Michael, Tecrera, Gratioſa, S. George, Pico, Fayal, Flores and Coruo.

Tercera amongſt all the reſt is the ſtrongeſt, and bringeth foorth Diers Wad, The Ile of S. Michael bringeth foorth Sugar, and great aboundance of good Diers Wad.

Corſica

COrsica is situate in the sea Mediterraneum, and bringeth forth most excellent wines, rough Horses, and great hunting dogges: and this Ile is gouerned by the Genueses.

SArdinia is a very fruitfull Ile, and chiefely of Wheate, which is transported from thence into Italy and into Spaine likewise it hath very good Wine, both red and white, and very good Salt, it hath also certaine mines of siluer, but not of so profitable yeelo as in times past. The inhabitants are strong, and are able to indure great labour and trauell. In great townes they speake the Spanish tongue of Aragon, but in small townes they speake the vulgar tongue of the Ile.

SIcilia hath beene alwayes famous, and is called of Diodorus the Paragon of Iles, also the Greekes and the Latines haue greatly celebrated this Ile in their writings. This Iland hath great aboundance of Wheate and of all other grayne, also of wine, Sugar, Saffron, Honey, Saffron, Silke, and of all things else appertayning to the vse of man. Wherefore this Ile, together with Ægypt was sometime called the Grange of the Romaines. In this Iland is the hill Ætna, which alwaies burneth, and in the sea of Sicill nigh vnto Drepano, as Plinie writeth in his 32. booke and second chapter. there groweth very faire redde Coral, in shape like to such a tree or bush as is here figured, which while it is vnder the water is greene and tender, but so soone as it commeth into the ayre, it waxeth hard like a stone, and is redde, there is found thereof also nigh vnto the sea coast of Prouince, also in Italy nigh vnto Monte arto, and to Naples, likewise in the red sea, and in the Gulfe of Persia, and there be three sorts of Coral, that is, red, blacke, and white.

CAndia sometime called Creta, was in olde time enritched with the famous Labyrinth, and with a hundred Cities, it had also a great number of good ships and expert Pilots, this Ile together with others, as the Ile of Zante, Cephalonia, Corfue, and diuers others be at this present gouerned by the Senate of Venice.

The

The Marchandizes transported out of Candia into other prouinces are these, noble wines as Malmsey, Muskadine, Corants graine of Scarlet, Sugar, Christall of the mountaine, Cotton, and Buckeskins.

NIgro Ponte, sometime called Euboia, is a very fruitful Ile in Wheate, Oyle and wine.

STalimine sometime called Lemnos, is an Ile which hath aboundance of Wheate, and most excellent wines. In this Ile they digge out in the moneth of August a certaine medicinable earth called of the Physitians, Terra sigillata. There be manany other Iles besides these in Europe, as in the Iles of Denmarke, the Iles of Zeland in Flanders, the Ile Frumentera, Iuica Maiorica and Minorica, and a number of Iles that are in Sclauonie and Greece.

ASia is seperated from Europe by the floods Tanais & Dwina and from Afrique by the narrow part of land, wich is nigh to vEgypt, betwixt the Mediterrane sea, and the red sea. Asia far exceedeth in greatnes both Europe, Afrique, and Peruana, & also in riches, as in pearles of great price, and precious stones and spices it exceedeth all the other countries of the world.

This region hath beene alwaies renowmed by the first and second Monarchie of the world, obtained by the Syrians & the Persians, as also it is at this day by the mighty Princes of China, and of Persia, and by the puissance of the Tartarians.

In this part of the world man was created of God, placed in Paradise, seduced by Sathan, and redeemed by our Sauiour Iesus Christ, and in this region, were done in a manner all the histories and actes mentioned in the old Testament, and a great part of those in the newe Testament. The most celebrated prouinces of Asia are those that belong to ỳ great Duke of Muscouia, also Tartaria and China, the rich prouince of India, as Guzarette, Corasan, Sigistan, Chirmania, Parthia, Persia, Media, Assyria, Armenia, Natolia Syria, and Arabia. The principall Iles of Asia, are these, Iapan, Luconia, Mendanao, Borneo, Sumatra

tra, Ceiland, & Cypres, for as for the Iles of Gilolo, Moluccas Banda & Celebes, they belong to that part of the world which is called Magellanica.

The most mightie Potentates of Asia are these, the King of China, the King of Persia, the great Turke, and the Emperour of Russia, otherwise called the great Duke of Muscouia according to which Seniories all Asia is divided into fire partes, that is to say, the Asiaticall prouinces, belonging to the great Duke of Muscouia 1. Tartaria 2. China 3. the Indies 4. the prouinces of the King of Persia 5. and those of the great Turke 6. And as touching the Asiatical Prouinces of the Emperour of Russia, and of the prouinces of Tartaria, we shall make mention thereof hereafter, when we come to translate the Tables or Inscriptions written in Latine, marked with the numbers 3. and 4.

The Contentes of the sixth page, wherein he describeth *China*, and the plant of pepper there growing, with the shape thereof.

CHina or Sina is the third part of Asia, sometime cal'ed of Ptolomy, Sinarum regio, which on the Eastside is enuironed with the sea called of the ancient Geographers Oceanus Siricus, or the East Ocean, and on the West it is bounded with the Indies and with Brumas, & on the North with Tartaria. This countrey is for many causes esteemed to be the most ample, the richest and most mightie Realme of all the world, for it extendeth from the 18. degree to the 55. degree of North latitude, and it containeth in longitude 450. leagues of Almanie, & it is deuided into 15. great prouinces or Realmes, that is, Quincii, otherwise called Paquin, Xanton, Xiancii, Sancii, Suchuan, Honao, Nanquii, Chequiam, Foquiem, Cantam, Quancii, Suinam, or Huinam, Quiecheu Fuquam, or Hucquam, and Quiancii. This Realme is aduyned with many nauigable Flouds, and full of Fish, it is very fruitfull

full, and bringeth foorth great abundance of all kind of graine and amongſt the reſt, of Rice, euery yeare three or foure times in a yeare. It hath goodly woods and forreſts, wherein doe kepe a number of wilde Boares, Foxes, Hares, Conies, Sables, and Martins. The mountaines are full of graſſe, ſeruing to féede infinite heards or troopes of Cattell, both great and ſmall. There be alſo many mines of precious ſtones, of Golde, ſiluer, Copper, Steéle, and Iron, and a great number of pearles, but not very round, and great abundance of ſilke. The townes there are very great, fortified, and well peopliſhed, which is eaſily knowne by the greatneſſe of Cantan, which is one of the leaſt Metropolitane Cities of the Realme, and yet it containeth in circuite 12. Italian miles, and 350 Geometricall parts, which is more then foure houres iourney, not reckoning the ſuburbs, which are very large and full of people. The principall Metropolitane towne where the King keepeth his Court, is named Paſquine or Suntie, that is to ſay in their tongue, the Celeſtiall or heauenly Citie, touching the greatneſſe whereof, the Portugalles and the Caſtilians doe write many incredible thinges, and according to the opinion of many, it is the ſelfe ſame towne which Marcus Paulus Venetus calleth Quinzay, as that which hath diuers names in diuers Languages. The like may be ſaid of a towne in Flaunders, which the French men call Lile the Flemings Ruſsill, and in Latine it is called Inſulæ. In theſe prouinces bee many good Ports and Hauens vpon the Sea, and a great number of ſhips. by reaſon whereof the Inhabitants are moued to ſay, that amongſt them, there are as many that dwell in Ships vpon the Sea, as be of them that dwell in houſes vpon the land. and that their King might eaſilie make a bridge to paſſe from China to the towne of Malaccha, which is diſtant from them 300. Almaine leagues But aboue all there is one thing worthie of great admiration, and that is a wall which hath in length 400. Spaniſh leagues, which the King of China cauſed to be built, to defend the countrey againſt the inuaſion of the Tartarians, of which thing if the antient men had had any knowledge, they would haue counted this worke among the ſeuen wonders of the world, The inhabitants are men of ſpirite, and giuen to labour. There was alſo inuented by them ſuch a kind

of

of writing, that euery man of what nation so euer he were, being somewhat exercised therein might pronounce in his mother tong, euen as it were ciphered. They inuented also certaine Charriots, wherein they might saple by the Winde vpon playne grounde, as they doe in shippes vppon the sea: There are also men amongst them that are well learned in all Sciences and especially in Architecture, wherein they excell all others, they are great louers of learning, and those that doe excell others therein are promoted to the most honourable estates: they haue good municipall lawes, and will suffer no Stewes, and they forbid that any man shall marrie any woman with whome he hath liued before in adultry, and they grieuously punish all offences, and doe forbid idlenes as the mother of many euils, yea they doe constraine blind men to get their liuing, by turnig with their hands milles made to grinde corne, or any other things, and in their warres against the Tartarians, they get the victorie more by fine pollecie and stratagems, and by multitude of people, then by prowesse or feates of Armes. The Portugals doe report that the King bringeth to the fielde 3000|000. footmen, & 200|000. horsmen. Now as touching their religion they be Paynims and superstitious Idolaters, sauing that there are in many places some Christians, as Marcus Paulus Venetus testifieth.

The chiefest Marchandizes transported out of China into other prounces are these, Gold, precious stones, Pearles, Muske Rubarbe, the medicinable roote, China, Purslane, aboundance of silke, Sugar, Rice, and all sorts of graine. The plant of Pepper is sowne at the rootes of other trees, but specially at the roote of that Indian tree, which is called Faufell, and at the roote of the Date tree, to the tops whereof it climeth vp, much like as Iuie doth vpon a tree, or like to that which is called in Latin Clematis in English perwinkle, wich will winde about euery hearbe that groweth nigh it, the root is but small, and his leaues thin like vnto Citron leaues, but somewhat lesse, and sharpe pointed, greene and biting in the taste, the graines doe grow nigh one to another, like the long grape, and are alwaies greene vntill they be through ripe and drie, there be two kindes thereof, that is, white and blacke, but the plants of both are much like to our white & red Vines. Pep-

per

per groweth in places neere the sea side of Malacha, and in the Iles of Sunda and Cuda, situated nigh vnto the Ile Iaua maior, but the best kinde of Pepper most plentifully groweth in the prouince of Malabar, betwixt the Cape Comori and the Cape Canonar, but long Pepper is found in the realme of Bengala, and is another kind of plant altogether vnlike to this.

The contentes of the seuenth page, wherein he first discribeth the red figge tree of India, and setteh downe the shape thereof, then he describeth the East Indies, and last of all hee sheweth the nature of the Elephant, whose shape he setteth downe in the same page.

THe Indian figge tree groweth round about Goa, the body thereof is high and great, and extending his branches in a rounde forme, which like yellow or golden fillets doe stoope downe towardes the earth, & so soone as it toucheth the earth, it bringeth foorth a new generation of trees which differeth nothing at all from the mother but onely in thickenesse, des Souches, & the branches of those do bring foorth new trees in like manner, in so much as the mother with her offspring will in short time spread as much ground as containeth an Italian mile in circuit, the fruites are small Figges, and red as bloud, as well without as within.

India tooke his name from the Flood Indus, which bordereth towardes the East vpon the Realme of China, and towardes the South vpon the greate Ocean of India, and towards the West vpon the sea of Arabia, and also vpon the Flood Indus, and towards the North vpon the sea Mare Euxinum, or Mar maior and vpon Bramas.

This countrie is iudged at this day, as it hath beene long since to be the noblest and richest countrey in all the whole world, and it is diuided by the Flood Ganges into 2. parts, whereof the West part is called Indostan, or India intra Gangem, and the East part is called India extra Gangem, and it containeth many prouinces

uinces and Realmes, as Cambaiar, Delli, Decan, Bisnagar, Malabar, Narsingar, Orixa, Bengala, Sanga, Mogores, Tipura, Gouros, Aua, Pegua, Aurea, Chersoneius, Sina, Camboia, & Campaa. These Prouinces are watred with a number of goodly riuers, amongst the which Indus and Ganges are the most renowmed riuers of the world. Moreouer, these Prouinces doe abound in all things that may grow either within the earth or vpon the earth, except it be copper and lead, as Plinie affirmeth, also all manner of Plants that grow there are very great, braue and excellent good. India exceedeth all other countries in precious stones and in spices, furnishing therewith almost all the world. It hath many rich mines of Gold, & great store of faire pearle, also great multitude of all manner of cattell, horses onely excepted, which are brought thither out of Persia and Arabia. It is not long since that Callicute was the chiefe towne of Marchandise in India, but at this present Goa is the chiefe: there is also great traffique vsed at Dio, at Cananor, at Cochin, at Bengala at Pegu, at Malacha, and at Sian.

Of the Elephant.

The Elephant amongst all other foure foted beastes is the greatest saue the Dragon and the Crocodyle, he is very ingenious, in so much, as it is incredible that which the auncient men write of him, and also the moderne, which haue sought more diligently to know his nature and disposition, he is of force incredible, and mete to drawe shippes and boats both out of the water and into the water, and to drawe artillerie and ordinance, he is also mete for the warre, his teeth that shoote out of his mouth are Iuorie, there is great number of them found in the Indies, and in Africque, but the greatest and fittest for warre are found in the Ile of Ceiland, nigh to Calicute.

The Contents of the eight page, in which he describeth the beast called Rhinoceros, and setteth downe his shape, and he describeth the Sinamon tree, shewing the shape of the trunke and of the leafe thereof, and also the Muske Cat with her

her ſhape and in the latter end of the page hee diſcribeth the Realme of Perſia.

THe beaſt called Rhinoceros, is as long and as large as the Elephant, but not ſo high, for his legs are ſhorter, he is armed not like a Tortiſe (as Plancius ſaith) for that is couered all ouer with one ſhell, whereas this beaſt is armed with manifold ſtrong, harde, and thicke ſkales, which are yellow and ſpotted with purple, hee hath a ſtrong horne or bone vpon his noſe, whereof he taketh his name, and he hath another little horne vpon his backe and he is a great enemie by nature vnto the Elephant, he is found in the Realmes of Cambria and of Bengala.

The Sinamon tree.

THe Sinamon tree, is as big as the Oliue tree, the branches and grafts whereof are very right, his leaues in collour are like to thoſe of the Laurel tree, but in ſhape like to thoſe of the Citron, his Flowers are white, and the fruites thereof are blacke and round like a hazell Nut, the Sinamon it ſelfe is no other but the barke of the ſaid tree, which groweth in the Prouince of Malabar, and in the Iles of Iaua and Mindanao, but the beſt is found in the Ile of Ceiland.

The Muſke cat.

THe Muſke Cat, is like in ſhape to a Common Catte, but ſhe is greater than either Catte or Fore, her muzzell is ſomwhat long and armed with ſharpe teeth, and with harſh haire, which haires (being angry) ſhe will ſet vp as a Swine doth his briſtles ſhe is in collour like a Wolfe, but that ſhe is ſpotted with blacke ſpottes, the nether part of her Muzzell and the haires of her beard are white, her feete are blacke, her flanckes are whitiſh, and

doe

doe ware whiter and whiter towards her belly, and next to her genitories, she hath a little bagge like to a bladder or purse, into the which doth fall the pretious greace or humour, which they call Ciuet and Zibeth, which Ciuet is gathered out from thence with a spoone, if shee be in mans keeping, but when shee is abroad and at her owne libertie, her bagge being full, shee will voyd that Ciuet of her selfe, and it will yeelde such a sweete sauour, as all they that saple by that coast may smell it a far off, as I haue heard. These muske Cattes are brought from the Realmes of Pegu and Tarnassary.

The description of Persia.

AS those in Persia haue enioyed in times past the seconde Monarchie of the world, so at this present they bee still very mightie, for the King of Persia is one of the greatest Potentates in the whole worlde, as hee which commandeth all the great Prouinces that doe border towardes the East vppon the flood Indus, and towardes the South vppon the sea called Mare Caspium and vpon the Flood Oxo, within which limittes, are comprehended all the greatest Realmes and landes, which the auncient Geographers were woont to call by these names, Assyria, Media, Susiana, Persia, Parthia, Hircania, Margiana, Bactriana, Paropanisa, Aria, Draugiana, Arachosia, Caramania, and part of Armenia maior, the which at this present are called by other names as you may see in the Map.

The Persians are a hardie and warlike people, and thought to bee the best ryders or horsemen in all the worlde, they haue very hard warres with the Turkes, they be of most free & gentle nature, louers of ciuilitie, they make great account of learning and Sciences, they honour Nobilitie, wherein they greatly differ from the Turkes. Now as touching their religion, they be Mahometists, and yet in such sort, as both they and the Turkes do count eche one the other as Heretiques in that religion.

From the Prouinces of Persia are transported into other parts of the world these Marchandizes, stones, called Turquesses, very faire and excellent pearles, great quantitie of silke, Uelues, Da-

maſke armour and a great number of moſt excellent horſes.

The Contents of the 9 page.

IN this page he diſcribeth and ſetteth down the ſhape of the pyecious ſtone named Bezar and the Dominions of the great Turke in Aſia, and the Cittie Aden in Arabia, alſo he deſcribeth ꝑ beaſt called Camelopardalis, and ſetteth downe his ſhape, alſo he ſetteth downe the ſhape of three of the greateſt Pyramides that are in AEgypt.

Of the ſtone Bezar.

THe ſtone Bezar or rather Pazar (for that is his right name) groweth in Perſia in manner de Boucz, named Pazan, which are of diuers coolurs, but moſt commonly redde.

This ſtone Bezar groweth in a concauitie in manner of a girdle about two handfull long and three inches broade, it is medicinable, and of great efficacie againſt all manner of poyſons and venoms, and many other maladies, there is to be found of them in the entrie of Malcha and alſo in Pegu, but the beſt of them are in Perſia.

Of the Dominions which the great Turke hath in Aſia.

THe great Turke doth poſſeſſe in Aſia, Natolia, ſometime called Aſia minor, and almoſt all Armenia, Meſopotamia, called at this preſent Diarbach, or Diarbekir, Syria, and a great part of Arabia, the moſt notable Merchant townes of this countrie are theſe. Trapezunda, Alepp, and a port vpon the ſea called Tripoli, alſo Aman Damaſco, with his port Barutti, and Mecha.

The Mar handizes that are ſent from theſe Prouinces into other countries are theſe, great quantitie of ſilke, Veluet, Damaſke

Turkie

Turkie Carpets, Cotton, and grain of Skarlet.

The Cittie Aden.

ADen is the chiefe Marchant towne of the vpper part of Arabia, which is gouerned by diuers Kings, and this towne sendeth into other Prouinces of the fayrest Pearles, the true Baulme, Frankensence, Myrrhe, and Horses.

The beast called Camelopardalis.

THis beast is called of the Arabians, Gyraffa, but the nam Camelopardalis is compounded of Camel and Pardale which is a Leoparde. hee hath a very long necke like vnto the Camell, & is spotted with many spotts, as is the Pardale or Leoparde, hee is a faire beast, and of gentle nature, as the sheepe. his head is like vnto the head of a Hart or Stag, but greater, his hornes are small topped, and couered with haire, and are about a handfull and a halfe long. hee hath eares, tongue and feete like to an Oxe, his forelegs are long and tall, and his hinder legs are short, whereby he seemeth alwaies to stand right vp, his head is somewhat higher than the Camell, and this beast is to bee found in Arabia, AEthiopia, and India.

The Pyramides.

IN AEgypt are many Pyramides, whereof the two greatest are counted amongst the seuen wonders of the worlde. the greatest of them (as witnesse Peter Belon) who most diligently viewed the same, is at the foote foure square, and euery square containeth in length 324. paces, and in hight 250. degrees or steppes, and euery steppe hath in breadth 45. inches, which is three foote and 9. inches, but he setteth not downe what depth euerie steppe hath, which must not bee ouer deepe: for then howe can any man easily mount vp to the toppe thereof, for hee saith it is plaine in the toppe, and so large as 50. persons may stand thereon. It is found by writing that 360000.

men wrought 20. yeares in building this Pyramides.

The second great pyramides is somewhat lesse and smooth on the outsides without any degrees, or steppes, and the top thereof is sharpe pointed.

The Contents of the 10. page.

IN this page he describeth the Crocodyle, and setteth downe the shape thereof, secondly, he sheweth whereof the Mummie is bred. Thirdly, he describeth the Unicorne, and setteth downe his shape,

The Crocodyle.

THe Crocodyle is found in AEgypt, in the flood Nilus, and in India in the flood Ganges, and in the two Prouinces Mexicana and Peruana in many riuers. This is a foure footed beast, which hath a horrible head, sharpe teeth, a very small tonge, and a thicke tayle, and his skinne is harde and armed with harde scales, the nether parte of his mouth is immooueable, and the vpper part mooueable, contrarie to al beasts, he doth deuoure both men and beastes, and doth keepe more in the water than on the land, and that which is greatly to bee wondred at, he is ingendred of an Egge, as great as a Goose egge, and he groweth by little and little vntill he come to the length of 18. cubites, or as some say to 22. cubites, which maketh 33. foote.

Of Mummie.

MUmmie is made of bodies embaulmed, which they bring from AEgypt, whereas many such embaulmed bodies were buried, about foure houres iourney beyond Cayre, whereas was sometime the great cittie of Memphis, for before the nativitie of Iesus Christ the Egyptians being Paynims did spare no cost to keepe the bodies of their Parents from putrifaction, and therefore they are great palpable lyes, whereby fooles are perswaded, that the Mummie proceedeth of those bodies which

which doe periſh in the ſands that be in the deſerts of Arabia, as though it were poſſible that thoſe bodies coulde bee preſerued in thoſe ſands without ſtench or putrifaction.

Of the Vnicorne.

The Unicorne, as Lewes Vertiman teſtifieth who ſaw two of them in the towne of Mecha, is of the height of a young horſe or colt of 30. monethes old, which is two yeares and a halfe olde, he hath the head of a Hart, & in his forehead he hath a ſharpe pointed horne three cubites long, he hath a long necke, and a maine hanging downe on the one ſide of his necke, his legges are ſlender, as the legges of a Goate, and his feete are clouen much like to the Gote, his hinder feete are hairy, and his haire in colour is like to a bay horſe. This beaſt in countenance is cruell and wilde, and yet notwithſtanding mixt with a certaine ſweetnes or amiablenes. His horne is of a marueilous great force and vertue againſt Uenome & poyſon. The Unicorne is found in AEthiopia, like as the Indian Aſſe is found in India, which hath likewiſe one onely horne in his forehead,

The Contents of the 11. Page, wherein he firſt deſcribeth Afrique, and then certayne fruites and ſpices as Nutmegs, Mace and cloues, and ſetteth downe the ſhape of them, then he ſheweth which bee the mightieſt Princes in Afrique, and thirdly he deſcribeth Mexicana, which is the firſt North part of America.

AFrique being the third part of the world, is ſeperated from Europe and Aſia by the ſea Mediterraneum and the red Sea, and by the land ſtraight which is betwixt AEgypt and Paleſtina. the chiefe Prouinces of Afrique are theſe, Ægypt, Barbarie, Biledulgarid Sarra, Athiopia, Nubia, the large Prouinces of the Abaſsines, falſely called the lande of Preſter Iohn, and alſo Monomotopa. The

most renowned Iles belonging to Africque are these, Socotora, Madagascar, S. Thomas, the Iles of Capo Verde, & the Iles of Canarie and Madera.

The Nutmegge tree.

THe Nutmeg tree groweth in the Ile of Bada, and differeth not much from the Peach tree, saving that the leaues of the Peach tree are shorter and rounder: The fruite is couered with a thicke barke or huske, which when it is ripe cleaueth in sunder, and sheweth the Nut together with the shell, which is couered with Mace, the which at the first viewe is as red as Scarlet, and pleasant to behold, but when the Nut wareth drie, the Mace to seuer from the Nut, and loosing by little and little their Scarlet collour, doe ware nigh vnto the collour of an Orange.

Of the Cloue tree.

THe Cloue tree groweth in the Iles of Moluccas, which in greatnes and shape is like vnto the Lawrell tree, saving that the leafe thereof is somewhat narrower. It hath many branches, and a great number of flowers, first white, afterward greene, and then red, but being dried, they become black. The cloues do grow vpon the outermost ends of the branches, one hard by another, and whilest the flowers are greene they excell all other flowers in sweet odour.

The chiefest Princes of Africa.

THe most puissant Princes of Africque are these, the Emperour of the Moores or Ethiopians, which of the Arabians and of the Mahometistes is called Aticlabasi, and of his owne subiects, hee is called Acegue and Neguz of the Abassines, that is to say, Emperor and King of the Abassines and Moores. Then the king of Monomotapa, the king of Morocho, the Kinge of Fez and Sus. The great Turke also possesseth many Prouinces in Africque.

The

The chiefest Marchandizes that come from Afrique into Europe are these, Gold, Iuory, wood of Ebony, Aloes, Baulme of Ægypt, Mummie, Mirrhe, Anil feathers, Sugar, Ginger, Dates and wines of Madera, and of the Ile of Canarie.

Mexicana.

MExicana which is the fourth part of the worlde, is on all sides enuironed with the sea, sauing that nigh vnto Nombre de Dios it is ioyned by land strait to Peruana. The chiefe prouinces of Mexicana are these, the prouince of Mexico, otherwise called noua Hispania, terra Florida, Norum Bega, noua Francia, Estotiland, Saguenay, Chilaga, Toconteac, Marata, California, Tolm, Quivira, Agama, and Anian. The chiefest Iles lying on the North & Northeast part of Mexicana are these Groynland, Crockland, Iſland, Frezland, Bacalaos, and Cuba.

The chiefe Merchandizes that come from Mexicana into Europe are these Gold, Siluer, Pearles, Cochenilles, to die with, Baulme, Salsaparillia, the root Mechoicana, brimstone, hydes of Oxen and Moluc.

The Contents of the 12. Page.

IN this Page hee first describeth the beast called in that tongue Aiotochli, in Spanish Armadillio. Then he describeth the two prouinces Peruana, and Magellanica, then he sheweth which be the most mightie Princes of the worlde, and finally the diuers qualities of the people inhabiting the world.

THe beast Armadillio is found in the Realme of Mexico, and he is no bigger then a cat, he is headed like a Swine, and hath the feete of a Herison, and a long tayle, he is armed with scales, whereof he taketh his name, he keepeth for the

most part within the ground, and as some suppose, doth liue by the earth, by reason that he is neuer seene to eat abroad out of his den, the bones of his taple are medicinable, and doe remedie the paine and deafnes of the eares.

Though Plancius saith that this beast is armed with scales, yet my countriman William Greenway, who is a proper seruitour both by sea and land, and hath beene in the West Indies, and hath eaten of this beast, affirmeth his flesh to be white & very delicate, and that hee hath no skales, but that his skin is white and smooth like to a pig new scalded, and that sometime he will shrinke vp the skin vpon his backe into diuers plates, and specially towards his fore parts and hinder partes in such sort, as he will make them almost to meete, and the former plaites doe hang downe vpon his shoulders like vnto two Peldrons, and his haire is white and short growing thin here and there one, and he is eared and tailed like a rat, euen as hee is here portraide, sauing that he is throughout of one selfe colour, and without scales.

Peruana.

PEruana being the fift part of the world, is also inuironed on all sides with the sea, saue whereas the foresaide landtrait doth ioyne the same to Mexicana, & the chiefe prouinces which it containeth are these, Brasilia, Tisnada, Caribana, Carthagena, Peru, Charchas, Chili, Chica, and the land of the Patagones. The most renowned Iles are these, Hispaniola, otherwise called S. Domingo, Boriquen, and Margarita, which is the Ile of pearls.

The Merchandizes which are transported out of Peruana into Europe are these, gold, siluer, Emeralds, Pearls, the medicinable stone called Bezoar, Bauline, Ginger, Suger, wood of Brasil wood of Guaicum, called Lignum vitæ, long Pepper, Pepper of Brasill, Cassia solutiua and hides of Oxen.

Magellanica.

THis is the first part of the world, which as yet is but little knowne, in such sort as we cannot write any thing touching the prouinces of the same, notwithstanding it is thought that the pro

prouince of Beach is very rich, and hath aboundance of Golde, the chiefe Iles of Magellanica are these, Iava maior, and Iava minor, Timor, Banda, the Molucques, Romeros, the Iles of Salamon.

From the Ile Timor doth come into Europe, the white and pale medicinable simple called Sandalum.

From the Iles Banda doth come Nutmegs and Maces.

And from the Iles Molucques Cloues.

Which bee the great Princes of the world?

THe most mightie Princes of the world are these fiue, that is, the King of China, otherwise called the great Cham 1. the K. of Persia 2. the great Turke 3. the Emperour of Æthiopia 4. the Emperor of Russia, otherwise called the great Duke of Muscouia 5. amongst which the King of China is a Pagan or Heathen: and the great Turke and the king of Persia are Mahometists: but the Emperor of Æthiopia and the great Duke of Muscouia doe make profession of the Christian religion. Now as touching the king of Spaine, his puissance should be much greater than it is, if his prouinces were not so seperated, and so farre distant one from another.

The qualities of diuers people in the World.

AS touching the qualitie of people, though God almightie hath created all men of one selfe bloode, and that all doe take their beginning from the Arke of Noah, and that all men be of one selfe qualitie and shape of body, yet they differ in greatnesse, in proportion of members, and in collour, for the Patagones, doe exceede all other creatures in greatnes. Againe, the men of China haue most commonly broad faces, little eyes, flat noses, and little beardes, and those that haue smallest feete, are counted amongst them to be most beautiful, those of Africa haue grosser & thicker lippes than other people, the inhabitants of Agysimba, and of Guinea, and specially of the lande that be nigh vnto Cape de bona esperanza, are blacke, from whome the Orientall Indians doe not much differ.

The

The Abalsines or Moores of Ægypt, bee of a duskish colour like to the Olliue, the Inhabitants of Barbarie, bee called white Moores, and those that dwell betwixt them and the Nigrites or blacke Moores, be of a yellowish collour, the Spaniardes haue not found either in Mexicana, or in Peruana any Nigrites or blackmoores, but only in certaine villages nigh vnto Carque, the other nations vnder the hotte Zone, bee of collour browne bay, lyke a chessenut, and the nigher that they dwell to eyther of the Poles Arctique or Antarctique, the whiter most commonly they be, and as touching the rest all are like in qualities, shape and fashion of body, as hath beene said before, wherefore they are meere lies that are woont to be tolde of the Pigmeans, in that they should bee but a foote and a halfe high, and likewise that which hath beene spoken of people, that should haue their heads, their noses, their mouthes, and their eyes in their breasts, or of those that are headed lyke a dogge, or of those that haue but one eye, and that in their forehead, or of those that haue but one foote and that so great, as that it couereth and shadoweth all their body, or of those that haue great eares hanging downe to the ground. All these are meere lyes, inuented by vaine men, to bring fooles into admiration, for monsters are as well borne in Europe, as in other partes of the world.

NOw in the foure pages following, hee setteth downe in the French tongue an interpretation of the Latine inscriptions dispersed throughout the Mappe, euery which inscription hath his number added, which I doe also heere set downe in the same order, ioyning to euery number his Longitude and Latitude, to the intent you may the more easily finde out the saide inscriptions of which inscriptions there be in all 71. diuided into fiue parts, whereof the first part containeth 21. inscriptions, belonging partly to Europe, but the most to Asia, the second part containeth 12. inscriptions belonging to Afrique, the thirde parte containeth 11. inscriptions, belonging to Mexicana, the fourth part containeth 6. inscriptions, belonging to Peruana, and the fift part containeth 21. inscriptions, belonging to Magellanica.

The

The 21. inſcriptions belonging to Europe, but moſt to Aſia doe here follow.

The number of inſcrip.	Longitude.	Latitude.	North or South.
1	5.	85. 30.	North.

THis arme of ẏ ſea doth take his courſe through thes places, running continually towardes the North pole, and is frozen three monethes of the yeare, and it containeth in breadth about 37. leagues.

2	38. 0′.	86. 30′.	North.

It is ſaid that this Countrey is inhabited of Dwarffes called in Latine Pigmei, being in height 4. foote as thoſe be of Groynland, which are called Screelings.

3	81. 0′.	77. 0′.	North.

Muſcouia is bounded on the North ſide with the ſea Pitzorique, called of the ancient Geographers Mare Glaciale, that is, the frozen ſea, and towardes the Eaſt it boydereth vpon Tartaria, and towards the South vpon the ſea called Mare Caſpium and alſo vpon the Turkes, and Tartaries Perocopſiques, and towardes the Weſt, it boydereth vppon Lituania, Livonia, and vpon the Realme of Swethland: as touching their Religion they obſerue the faith and ceremonies of the Greeke Church, al their Biſhops are called in their language Vſadiques, and alſo their Metropolitane are vnder the obedience of the Patriarch of Conſtantinople. The people is wiſe and ſubtill, and yet lauing ſeruitude more than libertie or freedome, and they all confeſſe themſelues to be the ſeruants and ſlaues of the great Duke hauing ſeldome or neuer peace, for either they haue warres with thoſe of Lituania, or with thoſe of Livonia, or with thoſe of Swethland, or with the Tartarians, or if they haue no warres, then they lie in garriſon nigh vnto the 2. floods Tanais and Dwina, to defend their bounds from the depredations and inuaſions of the Tartaries, they ſharply puniſh robbers and ſtealers, and yet priuie theft and murder is ſeldome puniſhed with death: their ſil-

uer

The number of inscrip.	Longitude.	Latitude.	North or South.

uer money is not rounde, but hath the forme of an egge, their countrie is euery where full of woods, and they haue great aboundance of rich furres, they send into all countries of Europe verie good Flaxe and hempe to make Cables and ropes, and a great number of hydes, as well of Oxen as of Elkes, great balles of Ware, much salted fish, and whales grease. The great Duke, called of his seruants the Emperour of Russia, is rightly accounted amongst the most mightie Monarches of the world.

4	98. 0.	82 0.	North.

This arme of the sea hath 5. mouthes or entries, and by reason that it is so straight and hath so violent a course, it is neuer frozen.

5.	123. 30.	58. 0.	North.

Under the name of Tartarie at this day are comprehended all the prouinces that border towards the East vpon the sea of China & towards the South, are limited with the prouinces of China, of India, with the flood Oxio, with the sea, Mare Caspium & with the lake or marish called Palus Meotis, & towards the West they are bounded with the flood Boristhenes, & with the limits of Muscouia: for the Tartarians haue conquered al the countries which they possesse at this present, so as Tartarie comprehendeth al that countrey which the auncient men were woont to call Sarmatia, Asiatica, and also the Scythias, that is, intra Imaum and extra Imaum, they began first to bee renowned in Europe, in the yeare of Christ 1212. The Tartarians are deuided into certaine commonalties, and Colonies, called of them Hordes, but for so much as they dwell in diuers prouinces, that do extend farre, & be farre distant one from another, they differ also in their maners and trade of life, they be men of a square stature, hauing broade and grosse faces, their eyes hollow sunke into their heads, and looking somewhat asquint, and thicke beardes, they be strong of body and hardy, they eate horses, and all other beastes, how so euer they are slaine, sauing hogges, from which they abstaine, they are able to endure hunger, thirst, watch, and all discommodities, and when they are distressed

The number of inſcrip.	Longitude.	Latitude.	North or South.

diſtreſſed in their voyages with hunger and thirſt, they let their horſes bloud, and with that bloud quench their hunger and thirſt, which kind of meat they cal in their language Beſermannen, they cal their Emperour Cham, that is to ſay, Prince, and therefore Cambalu is interpreted to be the ſeate or towne of the Prince.

6.	125 4'o.	50. o'.	North.

This round lake in the prouince of Sancii, tooke his firſt originall and beginning in the yeare 1557. by reaſon of an inundation or flood, which carried away 7. townes, beſides, vilages and other places nigh adioyning, and a great multitude of people, whereof none were ſaued but onely one infant, ſitting vpon a tree:

7.	124. o'.	37. o'	North.

The inhabitants of China, are of good ſpirite and ingenious, inſomuch as they haue inuented certaine kinde of carts, wherein they may ſayle vpon euen ground, hauing wind, and ſayle as they doe in ſhippes vpon the ſea

8.	171. 3'o	80. 30'.	North

Plancius in this inſcription ſetteth downe the opinion of Mercator, touching the beginning of longitude, and touching the Adamant ſtone, otherwiſe called the Lodeſtone, in Latine Magnes

Frances of Diep, a moſt ſkillfull Pilot, doth witneſſe that the needle of the Mariners compaſſe, doth turne directly to the North Pole, being in the Flandes of Capo Verde, that is to ſay, the Ile of Sal, the Ile of Bonauiſta, and the Ile of Mayo, whereunto thoſe doe agree very nigh, which do ſay that the needle doth the like in the Iles of Tercera, and of S. Marie, which are part of the Flemiſh Iles, otherwiſe called the Azores: but ſome others do affirme, that the needle ſheweth the North pole beſt, being in the Ile of Coruo, which is the furtheſt Ile weſtward of the ſaid Azores, and becauſe the Longitude of places by moſt liuely reaſons, ought to take his beginning from the common Meridian of the world, and from the rocke or Pole of the Adamant ſtone, we here

following

The number of inſcrip.	Longitude.	Latitude.	North or South.

following the opinion of thoſe that are moſt ſkilfull in this matter, haue ſet downe the firſt Meridian betwixt the Iles of Capo Verde, and the Azores, and becauſe the needle in all other places, declineth either more or leſſe from the Pole of the world, ther muſt needs be another Pole in ſome one place whereunto the needle doth incline from all coaſtes of the worlde, and I haue found by the declination of the needle obſerued at Ratisbone, otherwiſe called Regensberg that is the ſame place, which I haue ſet downe in the Mappe, and I haue likewiſe marked in this Carde, the ſituation of the Pole of the ſtone, in reſpect of the Ile Coruo, to the intent that according to the outermoſt places limitted by the firſt Meridian, the outermoſt bounds, betwixt which this Pole ought to be found, might be knowne, vntill the diligent and curious conſideration of the Pilots ſhall bring vs ſomething of more certaintie. Thus farre Mercator.

9	162. 0′.	71. 0′.	North.

Theſe are the plaine fieldes of Bargu, whereof the inhabitants are callyd Mecriti.

10	154. 30.	68. 0′.	North.

The Mount Askai, in which are to be ſeene the ſepulchers of the Kings of Tartary.

11	171. 30	70. 0′	North.

Upon this Mountaine are ſet by the Tartarians two trumpetters of braſſe, for a perpetuall memorie of their freedome, gotten.

12.	175. 0′.	67. 0′.	North.

The Prouince Vng. which of our men is called Gogg.

13	170. 30.	65 20.	North.

The Realme of Tendus, which in the time of Marcus Paulus

The number of inscrip.	Longitude.	Latitude.	North or South.

lus Venetus, (which was in the yeare 1290.) was gouerned by those Christians which descended from the king of Vncham.

14.	165. 30.	65. 0'.	North.

The Castle of King Vncham was builded in this place, against the inuasion of the Tartarians.

15.	157. 0'.	65. 30.	North.

The Prouince Mongul, which of our men is called Magogg.

16.	159. 20.	66. 0'.	North.

The desart Belgian, which is very great, all sandie and barraine.

17.	159. 0	61. 30'.	North

In this Countrie of Cergutha, is found the best sort of muske, which groweth like an impostume or bagge, nigh vnto the nauell of a certaine beast.

18.	165 30.	58. 0'	North.

Campion is the Metropolitane Towne of Ianguth, whereas the inhabitants are partly Christians, partly Idolaters, & partly Mahometists.

19.	158 30.	53. 0'.	North.

This wall hath in length 400. Spanish leagues, and was built betwixt the mountaines by the King of China, against the inuasions and excursions of the Tartarians.

.20	176. 0'	40. 0'	North.

Iapan hath three Ilands much renowned, seperated one from another by a straite of the sea, whereof the first and greatest is deuided into 53. Prouinces or Realmes, of which Meaco is the Metropolitaine cittie, the second called Xima, which hath nine Prouinces or Realmes, the third is called Xicoca which containeth but foure Prouinces or Realmes.

21.	71. 0'.	29. 0'.	North.

Medina Talnabi, is the towne wherein is to be seene the Sepulchre of Mahomet.

The-

The 12. Inſcriptions belonging to Afrique.

The number of inſcrip.	Longitude.	Latitude,	North or South.
1	67. 0′.	26, 0′:	North.

Coptos is a trim Marchant towne, whereto are brought the Marchandiſes of India, and of Arabia, in which towne are dwelling many Chriſtians.

2	58. 0′.	21. 0′.	North.

The flood Nilus, which by his inundations doth yearely water and fatte the Countrie of Egypt, & maketh it meruailous fruitfull.

3	55. 0′	17. 0,	North.

The flood Nubia, taketh his originall from the lake Nuba, as Ptolomie ſaith.

4.	50. 0′.	15. 0′.	North.

The flood Niger, heere taketh his courſe, running vnder the ground 50. leagues.

5	62. 0′.	5 0′.	North.

In this place is the ample iuriſdiction of the Emperour of Æthiopia, wrongfully called of thoſe of Europe, the lande of Preſter Iohn, the Arabes and the Perſes doe call him Aticlabaſſi, but his owne ſubiects do call him Acegue, and Neguz, that is as much to ſay, as Emperour and King.

6.	58. 30,	2. 30.	North.

The mount Amara, whereas are moſt carefully kept with continuall watch and ward of ſouldiers, the children and Grandchildren of the Emperours of AEthiopia.

7.	53. 0′.	7. 0′.	South.

It is ſaide that this countrie is inhabited of Amazones, which are women that make warre.

8.	55. 40.	15. 30′.	South.

The number of inscrip.	Longitude.	Latitude.	North or South.
In this place the King of Monomotapa, hath his great and ample iurisdictions.			
9	42. 30.	15. 40.	South.
This South part of Africque, vnknowne to the auncient writers, is called by those of Persia and of Arabia, Zanzibar.			
10	45. 30	1. 0′	South.
Heere is digged out of the Mines, great aboundance of golde.			
11.	30. 20	20. 0′.	North
Libia, or inwarde Africque, is at this day called Sarra, or the deserts.			
12.	19. 0′.	15. 30.	North.
The people Azanagi, are of colour blacke grap, and they couer their mouthes as a member of shame, and doe neuer vncouer them but when they eat			
The 11. Inscriptions belonging to Mexicana.			
1.	301. 30.	81. 0′.	North.
This Ile is thought to be the best and most holesome of all the North parts.			
2.	301 0′.	74. 0′.	North.
The Ile of Crockland, the inhabitants whereof say that they had their originall from Swethland.			
3	311. 0′	16. 30′	North.

In the yeare of our Lorde, 1500. one Gasper Corteriale a Portingale, entred into these Regions, hoping to haue founde some passage on the North towardes the Iles Moluques, but arriuing at the Riuer, which by meanes of the abundance of snow there falling, is called Rio Neuado, which hath in North Latitude 62. degrees, he did leaue to sayle any further towardes the North, by reason of the great colde there, and turning to the South did fetch in all the sea coastes vntill hee came to Capo Razo, which hath in North Latitude about 48. degrees: and in the yeare 1504. the Brittans were the first that

The number of inscrip.	Longitude.	Latitude.	North. or South.

discouered al the sea coastes of new Fraunce in America, nigh vn to the Gulfe of Saint Laurence, which hath in North Latitude about 50. degrees, and in the peare 1524. Ioha Verazzana ℞ Florentine, did part from the Porte of Diep, the 17. of March, in the behalfe of Frances king of France, and sayled towardes the South sea coast of new France, whereas he arriued at the 34. degree of North Latitude, and from thence sayled towards the East, viewing all the sea coastes vntill he came to Cape Britaine, which hath in North Latitude about 46. degrees.

3	311. 0'.	61. 30'	North.

And in the peare 1534. new France was againe visited by the Admirall Iaques Cartier, and in the peare next following, it was conquered to the vse of the King of France, also in the peare 1577 Martin Forboſher Englishman, arriued at the north straite which is betwixt Groinland ℞ Estotiland that place hauing by this Map in the North latitude 65. deg. seeking passage by the North vnto Cathay, wheras he found certain Iles, ℞ a mine of golde, wherwith hauing loden his ships, hee returned into Englande with great hope of profit, but his succesſe was not answerable to his hope.

4	275. 2'0	70. 0'.	North.

This dangerous beast is called Sucaratha, which being chased of Hunters, doth take her yong ones vpon her backe to saue both herselfe and them by flight.

5.	271. 0'.	64. 30.	North.

This is a great lake or sea of fresh water, the limites wherof are vnknowne as they of Canada do say, and as they haue heard by relation of those Saguenay.

6	293. 30	52. 0'	North.

Alongst this Riuer a man may sayle verp commodiously, towards the countrey of Saguenay.

7.	287 0'.	44. 40.	North.

All those that dwell betwixt Terra Florida, ℞ Terra de Laborador be called by one cõmon name Canadois, but there be many diuers Nations as those of Hochelada, Honqueda, ℞ Corterealia,

The number of inscrip.	Longitude.	Latitude,	North or South.
7.	287. 0.	47. 40.	North.

lia, they are all very courteous to strangers, they liue commonly by fish, & they are clothed with skins of wild beasts, as they be also that dwell further towards the North. this countrey is also called new France, because the Britains which are French men did first discouer it in the yeare of our Lord 1504. the conquest whereof was atchieued by the Admirall Iaques Cartier in the yeare of our Lord 1535. to the behoofe and vse of the French king. In the mountaines towards the South, do dwel many and diuers Nations, which be cruell people, liuing without any law, & do seeke by continuall warre to vexe and oppresse one another, as the people Auanares, Albardi, Calicuares, Tagi'es, Apalcheni, Mocose, Capaschi, Chilage, and many others, amongst which there bee some of such agilitie and swiftnesse, as they may contend with horses, who can run fastest: they eat as those of Florida, certain kind of Spiders, Ants or Pismires, Leazards, Adders & other venemous beasts. The land of Baccalaos, is so called of the fish Baccalaos, which is there taken. Terra Florida is so called of Easter day, because Iohn Ponce of Lion did discouer it on Easter day, in the yeare 1512. the which day is called of the Spaniards Pasqua du Flores: this is is fertile countrey and rich in gold.

8	271. 0'	39. 0'	North.

Marcus Nizza testifieth that this Prouince called the seuen Cities, is a very good countrey with whom Frances Vasker doth not agree, for he saith they be places of no value, and like to Villages, and bee vnder the iurisdiction of Ceuola, which at this present is called of the Spaniards Noua Granada.

9	211. 40.	82. 0'.	North.

The North Ocean sea, entring with 19. mouthes betwixt the Iles of the North, doth make foure straits of the sea, and running floods, which continually take their course towards the North & there are swallowed into the bowels of the earth, like to springes of fountaines and floods.

In mine opinion this Inscription would haue beene one of the

The number of incrip.	Longitude	Latitude	North or South.

first of Mexicana, and not one of the last, sith it is no small leape, to turne so suddenly from the middest of America to the North pole.

10.	223 0′.	55. 40′	North.

This countrey is desert and plaine, in which are many wilde Horses, and Oxen with high backes like Camels. and wild sheepe like vnto those which Boetius writeth (in his discription of Scotland) to be found in one of the Iles of the Hebrides.

11.	240. 2′0.	40. 3′0.	North.

New Spaine was brought by force of armes vnder the obedience of the Spaniard, in the yeare 1518. by their generall, Ferdinando Cortes, who conquered the same with great losse of his soldiers, but with greater ruine to the inhabitantes, who fought for the libertie of their Countrey: the soile is very fertill, and the Countrey is rich in gold, and siluer, for in the floodes are founde great sands of gold, and in the mountaines is drawne out of the mynes great quantitie of siluer, and alongest the sea side they take to their great profite an infinite number of Oysters, whe, ein are found very fayre Pearles. In this Prouince there are many salt lakes, the water whereof by force of the Sunne is turned into salt: there groweth also great abundance of Cassia fistula, and another kinde of fruite, which the inhabitantes call in their tongue Cacao, it is like to an Almonde, they haue it in great price, for of it they make a certaine drinke, which they loue maruellous well. The sea and floods which doe wash this Prouince, doe furnish them with great plentie of fishe, and in those floodes are many Crocodiles, whose flesh the inhabitants doe eat, and this beast will grow to be twentie foote long and aboue. This countrey is full of great mountaines and high rocks there is great diuersitie of languages, in so much as one vnderstandeth not another without an interpreter. Mexico is the Metropolitane and Royall towne, or rather the Queene of all the principall Townes in the worlde, it is situated vpon the side of a

lake

The number of inscrip.	Longitude.	Latitude.	North or South.
11.	240.2′0.	40. 3′0.	South.

lake or marish, yea the verie foundation of it is a verie marish, in such sort, as you can neyther enter into it, nor come out of it, but by bridges, and it is as well peopliſhed with inhabitants & Marchants, as any renowmed Marchant towne in Europe, the towne is verie great, for it containeth in cirtuit 3. Spanish leagues.

The 6. inscriptions belonging to Peruana.

1.	335. 0′.	3. 30.	South.

This great flood Maragnon, is called of some Oreigliana, and also the flood of the Amazones, it was discouered by Vincent Iohn Pinsonio, in the yeare 1499. and was sayled in a manner from the head spring euen vnto the sea, by Francisco Oreigiano in the yeare 1542. the which voyage he performed in eight monethes, hauing sayled 1660. leagues. This riuer keepeth his water still fresh after it is entred certaine leagues into the Sea, by reason that his course is so swift and violent.

2.	330. 3′0.	22. 0′.	South.

Peruana is the South part of America, and is diuided by the Spaniards into fiue goodly prouinces, that is to say, Castiliador, that is to say, the golden Castilia, Pompaiana, Peru, Chila, and Bresille: The Prouince Peru (before the arriuall of the Spaniards) did extend a great deale further, when as their Countrey was yet vnder the Gouernement of their naturall King, which then was called Ingas. as Girana and others doe write. At this present it is limited on the North with the towne Quito, and towards the South with the towne of Plata, that is to say, the siluer Towne, and it was called Peruana as some write, of the flood and Port of the Sea called Peru. It is at this present deuided (according to the situation of the Countrie) into three parts, that is to say, Sierras, Andes, and the flat or plaine Countrie.

The plaine Countrey is that which lieth alongest neere to the Sea coast.

The number of inscrip.	Longitude.	Latitude.	North or South.
2.	330. 30	22. 0′	South.

Sierras is that part which is full of mountaines.

And Andes is that part of the Mountaines which tendeth towardes the East. Of all the Prouinces in the world, this is the richest in golde, and in Emeraldes, the Metropolitane Towne of this Prouince, is the Cittie Lyma, otherwise called the Towne of Kinges. Castillelledor tooke the name of the great aboundance of gold that is there. The Prouince Propaiana tooke his name of the renowmed Towne Popaian. Chila, is a cold countrie by reason that it is nigh vnto the south Pole. The Prouince Brasilia, tooke his name of the wood called Brasill, which groweth there in great aboundance. To these Prouinces were meete to be ioyned these other Prouinces, that is to say, Caribana, Charcas Chica and the land of the Patagones.

3	329. 0′	28. 0′.	South.

This beast is called of some Haute, but of certaine people of Brasill, it is called Haye, which beast was neuer seene to eate or drinke, as some write, and therefore some thinke that she liueth without meat or drinke, onely by the ayre.

4	328. 0′.	35. 20	South.

This kinde of beast is found in the Prouince of Parias, which in her fore parts is like a Fore, and behinde she is like an Ape, sauing that she is foted like a man, she hath the eares of an owle, and vnder her ordinarie belly, she hath also another bellie, which openeth and shutteth, wherein she lodgeth her young ones, vntill they are able to get their own liuing, and she neuer suffereth them to goe out, but only to sucke. Gesner calleth this Beaste an Apefore, or a Fore-Ape.

5	329. 30.	36. 30.	South.

This is the land of the Patagones, the inhabitants whereof are Giants nine or ten foote high, which doe paint their visages with diuers colours, made of herbes.

In

The number of inscrip.	Longitude.	Latitude.	North or South.
6.	335. 0′.	51. 30.	South.

In the yeare 1582. the King of Spaine commaunded here to be built certaine fortresses, at the entrie or mouth of the straight, called Mare Magellanicum.

The 21, inscriptions belonging to Magellanica.

11	188. 30.	17 20.	South

This land is new Guinea, so called of the Nauigants and Pylots, because the sea coast and situation thereof, is like to that of Guinea in Afrique, and it was called by Andrew Corsali the Florentine, the lande of Piccinacoli, and perhaps it is that which Ptolomie calleth the Ile Labadia, if it may bee called an Ile, for it is not yet knowne whether it bee anie part of the South firme land or no.

2	209. 0′.	31. 30:	South.

It is not vnknowne to all those that are exercised in Geographie, that the degrees of Longitude doe diminish and decrease frō the Equinoctiall to eyther of the Poles, eyther North or South, whereby it falleth out, that the Prouinces which are next vnto the two Poles of the world, do differ greatly from the naturall shape which they haue by the roundnes of the earth, and for that cause wee haue heerein drawne a description of the whole world in two round figures or circles at the end of this Mappe, to the intent that euerie man might see their naturall situation so farre as may be shewed in Plano, that is to say, in flat forme.

3.	231	72.	North.

These Prouinces at this present are little knowne, yet it is said, that they are full of many kindes of wild beastes. You shall finde this inscription in the round figure on the left hand nigh to the North pole, which indeede belongeth to Mexicana, and not to Magellanica.

4.	247. 20.	14. 0′.	South.

These two infortunate Ilandes were so called by Magellane himselfe, because he could finde in them neither men, nor any thing

The number of inscrip.	Longitude	Latitude	North or South.
4.	247 2'0.	14. 0'.	South.

else that was meete for mans sustenance.

5.	283 0'.	61. 2'0	South.

These Prouinces were discouered by a Spaniard, who being seperated by tempest at sea from the fleet or armie, ran wandring here and there through this great Southerne Sea.

6.	350. 4'0	85. 2'0.	South

In the yeare 1493. when as the desire to saple into farre countries increased more and more amongest the Castilians and Portugales, and that with great contention who would discouer most, Pope Alexander ordained, that the Meridian which is 100. leagues distant towardes the West, from euery one of the Ilands aswell of Capo Verde, as of those which they call Azores should be the bounds and limits to eyther partie, for their nauigation, determining their rights in such sort, as the Castilians should haue the West part of the world to find out vnknowne countries, and the Portingales the East part, but there was such strife and contention betwixt them afterward touching the bounds of nauigation, as this ordinance of Pope Alexander pleased neyther partie, and therefore in the yeare 1524. it was fully determined, that the Meridian which is distant 370. leagues towardes the West from the Ile Saint Anthonio, being the most Westerne Ile of all the Iles of Capo Verde, should be the common bound of Nauigation to both parties.

7	19. 0'	54. 3'0	South.

Here vnder the latitude 42. degrees, & distant 450. leagues, from the Cape de bona speranza, and also 600. leagues distant from the Cape Saint Augustine, was found the Promontorie of the Southland, as Martin Ferdinando Denciso hath noted in the Epitome or summe of his Geographie.

8.	22. 0'.	65. 0'.	South.

In this our Geographie, wee haue in such manner described the circuite of the whole earth, as all the Countries are situate-

The number of inscrip.	Longitude.	Latitude.	North or South.
8	22. 0	65. 0′	South.

ted vnder their proper Meridians, which coulde not haue beene done, without extending them more or lesse from the west towards the East, notwithstanding being desirous to satisfie those that are practised in the Arte of Nauigation, wee haue described the North Prouinces of Europe in this our Geographie, in such sorte as their situation wholy agreeth with the particular Mariners Cards.

9	57. 20.	54. 0′.	South.

The 9. Inscription intituled to the louers of Geographie.

Wee haue in this inscription of the whole earth, employed all diligence to describe all the Seas and Prouinces, in such sort as euerie place may haue his true Longitude and Latitude, in which matter, we haue spared neither labour nor cost, for wee haue diligently conferred together the Sea Cardes, as well of the Castilians as Portingales, which they vse in their Nauigations to America, and to India, amongest others wee obtained from Portingale a Mariners Carde, describing the whole earth very correctly, and besides that fourteene other particular Cardes, in the which likewise all the Seas and Prouinces of the whole worlde, with their situation were comprised, all which Cardes being compared together, wee doe heere nowe set foorth this newe description of all the Prouinces and Seas in the whole worlde, and that as correctly as may bee, according to the consideration and obseruation which hath beene vsed by the most expert Geographers and Pilots, euen vnto this present houre: for in this Carde we doe describe all the sea coastes, Promontories, windinges in and out, Iles, Portes, deapthes, sands, shoulds and rockes, also we haue added thereunto in place conuenient, the Mariners compasse, and the lines of the windes, which wee haue set downe as correctly as was possible for vs to doe, for the commoditie of Nauigation: and for so much as the true Longitude of the places can not well be obserued, without extending or enlarging too far those Prouinces that are nigh vnto the North or South Pole of the worlde, we haue therefore briefely comprehended the lands in

this

The number of inſcrip.	Longitude	Latitude	North or South.
9	57	2'0 54 0'	South.

this our deſcription of the world, in two rondles or circles, vnto the which wee haue added another little Geographicall Carde, comprehending the north Prouinces of Europe to the intent that in them euery man may ſee with his eyes, the naturall ſituation of thoſe Prouinces as well as it may be done in Plano, as is more amplie declared in other inſcriptions of this Map. And this little Septentrionall Map laſt mentioned, is placed at the foote of this Mappe, in the verie middeſt thereof comprehending all the north parts that lie betwixt the 52. degree, and 72. of Latitude.

10	79. 30'	56 0'	South.

Here is a verie ſtrong current of the Sea, which runneth Eaſt and Weſt betwixt Madagaſcar and the Ile Romeros, in ſuch ſort as Nauigation, there is verie troubleſome and laborious, as Marcus Paulus Venetus teſtifieth in his third booke & 40. chap: whereof it muſt needes follow of neceſſitie, that the ſea coaſtes of this countrie are not farre diſtant from Madagaſcar, in ſuch ſort as the great Orientall ſea doth ebbe and flow through this ſtraite with great violence into the Weſt Ocean ſea, whereunto agreeth the letter miſſiue of a Candiot, who was Embaſſador for the Venetians to the King of Portingale In which letter he writeth that the men of this Countrie goe all naked.

11	91. 0'.	35 0'	South.

To this place arriueth a Portingale ſhipe called ſaint Paul

12	212.	36	South.

The South firme land, is called of ſome Mgellanica of Ferdinando Magellanus, who firſt diſcouered the ſame.

This inſcription, together with the foure next following, are to be found in the rondle on the right hand.

13	146.	46.	South.

Marcus Paulus Venetus and Lewes Vertiman doe teſtifie in their bookes of peregrination, that here be verie great and ample deſerts.

The number of inscrip.	Longitude.	Latitude.	North or North.
14.	75.	25.	North.

Betwixt the Ile of Saint Laurence and the Iles Romeros doe fall a most violent fluxe and refluxe of the Sea, East and, West.

15.	46.	55	South

This is the land of Popeniayes, so called of the Portingales, because those birdes in that countrey are of incredible bignes.

16.	15	46.	South.

This Promontorie of the South land is situate 450. Spanish Leagues from the Cape de bona speranza, and 600. Leagues from the Cape of Saint Augustine.

17	148. 0′	34 0′	South.

As we haue in the first rondle on the left hande set downe the description of that part of the world, which extendeth from the Equinoctiall to the North pole: so in this other rondle wee haue set downe a description of that part of the world which extendeth from the Equinoctiall to the South pole, in such sorte as this rondle contayneth all Magellanica, and almost all Peruana together with a great part of Afrique, and a great number of the most noble and renowmed Iles in the world, & herein you may plainelie see with your eye, the naturall situation of those Provinces that are nigh unto the South pole.

18	148. 30.	20. 30′.	South.

The Realme of Maletur, which aboundeth in all manner of spices.

19	148. 0′	15. 40	South.

The countrie of Breach is rich in gold. but little frequented by Marchants of other Countries, by reason of the crueltie of the people.

20.	161. 0′.	20 . 0′.	South.

Iava Minor, bringeth foorth diuerse spices which haue not yet beene seene in Europe, as Marcus Paulus Venetus testifieth in his third booke 13. chapter.

21	170. 4′	3. 0′	North.

The

The Iles Moluccas are much renmoued for the great aboundance of ſpices, which are ſent from thence into all Countries of the world: The chiefeſt of thoſe Iles are theſe, Ternarie, Tidoris, Motir, Machian, and Bachian, vnto which ſome do adde Gilolo, Celebes, Burro, Amboino, and Bandar.

Beſides all theſe inſcriptions Plancius at the 4 corners of his Map ſetteth downe 4. rundles, two aboue, & other two beneath: & in that aboue on the left hand, repreſenting the Northerne halfe of the celeſtiall Globe hee deſcribeth all the North ſtars that are already, and in the other rundle on the right hand repreſenting the Southerne halfe of the celeſtiall Globe, hee doth not onely ſet downe, ſuch Southerne ſtars as were knowne to the auncient Aſtronomers, but alſo ſuch Southerne ſtarres, as haue béne founde out of latter dayes by thoſe that haue trauailed into the Eaſt and Weſt Indies, as the Croſſe, the Southerne Triangle, Noes Doue or Pigeon, and another in the ſhape of a man, called Polophilax, and certaine others, touching which ſtarres hee ſetteth down nigh vnto the foreſaid rundle, a certaine inſcription written in the Latine tongue, which I haue heere interpreted word for word in our mother tongue as followeth.

We haue here ſet downe the fixed ſtarres in their true places anſwerable to the yeare 1592. and not 95. as the Printer hath made it

Of the South Pole and of the ſtarres that are about the ſame.



Eaſt the ſouth part of this Hemiſphere or halfe Globe, ſhould remaine void and emptie, I haue taken theſe Southerne ſtarres of the obſeruation of Andrea Corſalius Florentine, and haue diligently compared the ſame with the writings of Americus Veſputius, and of Petrus Medina, & haue reduced the ſaide ſtars into this forme or ſhape, But for ſo much as I haue ſeene nothing as yet to my ſatisfaction or contentment touching

ching the Longitude, Latitude, Magnitude or nature of the said stars, I hartely pray all those that haue any more certaine knowledge of this matter then we, that they will informe vs thereof to the common good of all men: As touching the pole Antarctique Corsalius writeth that there be two cloudie stars of a meane bignesse, which with a circular motion doe goe about another starre, that is distant from the Pole almost 11. degrees, and are sometime aboue and sometime beneath the saide starre, Hitherto Plancius. But now to the intent that you may the better vnderstande all the foresaide foure rondles, I thinke it not amisse to describe the same vnto you, and to shew the vse thereof as followeth. You haue to note then, that the two vpper rondles: that which is on the left hande, signifieth the Northerne halfe of the celestial Globe and the other rondle on the right hand, signifieth the Southerne halfe of the saide Globe as hath beene saide before, and each one of these rondles is traced with certaine circles and lines: The outtermost Circle whereof being deuided into 360. degrees, and containing the Characters of the 12. signes, signifieth the Zodiaque, or rather the very Ecliptique it selfe, the Centre of which Circle, is the pole of the Zodiaque, which by continuall turning about describeth another lesser Circle harde by it, signifying in the North rondle the circle Arctique, & in the South rondle the circle Antarctique. the Center of which lesser circle in eyther rondle is the pole of the worlde, both which poles are distant from the pole of the Zodiaque 23. degrees 28. which is the greatest declination of the Sunne. Moreouer in either rondle are drawne vpon ech Pole of the worlde, two other circles, the largest whereof signifieth in both rondles the Equinoctiall, and the lesser thereof in the North rondle, signifieth the Tropique of Cancer, and in the South rondle the Tropique of Capricorne: besides these circles ech rondle is traced with 12. ribbt lines, signifying those fiue Meridians or line s which passing thougb both the poles of the Zodiaque, doe diuide the Zodiaque into 12. equall partes, euery part containing 30. degrees: for so many degrees doe belong to the Longitude of euery one of the 12. signes, whereby the Zodiaque hath in Longitude 360. degrees which Longitude is to bee counted from the first point of Aries and so forth, according to the

succession

ſucceſſion of the ſignes, and by helpe of theſe lines, you may know vnder what ſigne any fixed ſtarre is: I ſhall not neede here to ſhew you how the ſaid fixed ſtarres are ſituated in eyther of the rondles nor how they are named, becauſe their images or ſhapes together with their names are apparant for your eye. But if you woulde know the true place, the Longitude, Latitude, Magnitude & the nature of any fixed ſtarre herein contained, then doe thus: firſt to know the place and Longitude of any ſtarre, lay a ruler or extend a threed, ſo as it may paſſe through the Pole of the Zodiaque and alſo through the body of the ſtar, whoſe place and Longitude, you ſeeke, euen to the very Zodiaque, and ſomewhat beyond, and thereby you ſhall know in what ſigne, and in what degree thereof that ſtarre is, for that is his place, and you ſhall know his Longitude by counting from the firſt point of Aries, vnto that degree for that is his Longitude.

Now to know the Latitude of any ſtarre, you haue to note that in eache rondle there is a certaine right blacke line extending from the Zodiaque to the Pole, diuided by vnequall ſpaces into 90. degrees, which line is called the ſkale of the fixed ſtarres Latitude, the vſe whereof is thus: Set the firme foote of your Compaſſes in the very pole, and extend the other foote into the middeſt of the bodie of that ſtarre whoſe Latitude you ſeeke, and turne that foote ſtanding at that widnes to the ſcale, and the number of degrees written vpon the ſkall, if you count from the Zodiaque vpward towardes the Pole, will ſhew you the Latitude of that ſtarre. Againe, to knowe the magnitude of any ſtarre, Plancius ſetteth downe in the North rondle the ſelfe ſame meane which Mercator alſo vſeth in his celeſtiall Globe, that is to ſay, by making certain ſhapes of ſtarres repreſenting the bigneſſe, of euery ſtarre, according to his greatneſſe, that by marking & comparing thoſe ſhapes together, you might find out, or rather coniecture the greatneſſe of the ſtarre which you ſeeke. Laſtly he ſheweth the nature of any ſtarre by ſetting downe nigh vnto the ſtar the characters of thoſe Planets, of whoſe nature that ſtarre doth participat, all which thinges you ſhall more plainely vnderſtande by this example here following.

Suppoſe that you would know the place, longitude, latitude,

magnitude

magnitude and nature of the ſtarre called Arcturus: there becauſe this is a Noꝛth ſtarre, you muſt theꝛefoꝛe reſoꝛt to the Noꝛth rondle, and there ſeeke out the image Bootes, betwixt whoſe legs is the ſtar called Arcturus which you ſeeke. And by extending a thꝛed which may paſſe thꝛough the pole, and alſo thꝛough the body of that ſtarre euen to the Zodiaque, and ſomewhat beyond, you ſhal finde his place to bee in the 19 degree of the ſigne Libra, and his Longitude counting frō the firſt point of Aries, vnto that degrē to be 199. degrees, and by obſeruing the rule before giuen, touching the knowing of the Latitude of any ſtarre, you ſhall with your Compaſſe finde the Latitude of this ſtarre to be almoſt 32. degrees Noꝛthwarde, and by his ſhape you ſhall know that he is of the firſt magnitude, and the characters of the two Planets Mars and Iupiter, placed hard by him, do ſhew that he is of their nature, that is to ſay, by participating of Mars he is extreamely hotte and dꝛy, and by participating of Iupter he is hotte & moiſt, and looke what oꝛder is to be obſerued in the Noꝛth rondle touching the Noꝛth ſtars, the ſame is likewiſe to bee vſed in the South rondle containing the Scutherne ſtarres: Amongſt which you may ſee the Images called the Croſſe, whereby moſt Pilots in theſe dayes doe chiefely direct their courſe being once paſt the Equinoctiall towardes the South pole. which Croſſe though Plancius doth here make to conſiſt of fiue ſtarres, yet I am ſure that Martin Cortes and Peter Medina and all other late wꝛyters do appoint thereunto but foure ſtarres, the ſhape and vſe whereof I haue ſet downe in my Treatiſe of Nauigation, accoꝛding to the direction of Peter Meridina. And thoſe that haue trauelled into the Indies, doe all affirme that to the Croſſe there doe belong onely foure ſtarres and no moꝛe, whereſoꝛe I maruayle much that Plancius doth ſet downe fiue, whereunto peꝛhaps hee is induced by the relation of ſome Spaniarde that did miſtake them. Thus hauing deſcribed vnto you the two vpper rondles, repꝛeſenting together the celeſtall Globe, and alſo ſhewed the vſe thereof, I will nowe deſcribe the two neather rondles, whereof that on the left hande repꝛeſenteth the Noꝛth halfe of the Terreſtriall Globe, & that on the right hand the other halfe of the ſame Globe, towardes the South.

you haue then to vnderstande that the Centre or middle point in each rondle, signifieth the Pole of the worlde, that is to say, the Northe pole in the Northe rondle, and the South pole in the South rondle, and vpon each pole are drawne certaine Circles, the outtermost whereof, and furthest distant from the Pole signifieth the Equinoctiall, which is deuided into 360. degrees, euery degree containing 60. miles, which is the whole Longitude of the earth, from which circle at the end of euery tenth degree, are drawn certain right lines to the number of 18. which doe meete in the very Pole, and doe signifie halfe Meridians, whereof that which passeth through the Iles Azores, and also the Iles of Capo Verde, is the first Meridian, from whence the longitude of the earth taketh his beginning, and there also endeth: which Meridian in the rondle on the left hand, is deuided into 90. parts, proceeding from the Equinoctiall to the Pole, signifying the Northe Latitude of the worlde. the like diuision and number of degrees of Latitude, hath also the first Meridian, in the rondle on the right hande, sauing that the saide Meridian tendeth vpwarde. Moze ouer you haue to vnderstande, that in each of these rondles are drawne nine Circles, equally distant one from another called Paralels which together with the Equinoctiall, doe make nine spaces euery space containing 10 degrees, & besides these circles, there are drawne in each rondle two other circles, the one greater & the other lesser, the greater in the rondle on the left hande being distant from the Equinoctiall 23. degrees 30. which is the greatest declination of the sunne, is called the Tropique of Cancer, and the lesser Circle being of like distance from the pole, is called the Circle Arctique, but the greater circle being of like distance from the Equinoctiall, in the rondle on the right hand, is called the tropique of Capricorne, and the lesser circle in the saide rondle inuironing the Pole, is called the Circle Antaretique vpon which circles in each rondle you shall finde their names written. The chiefest vses of these two rondles are these: first to finde out the Longitude of any place: secondly the Latitude, and thirdly the distance betwixt any two places.

To finde out the longitude of any place, you must doe thus: Extende a threede, so as it may passe through the Pole, and also

through

through the place whose longitude you seeke, euen to the very Equinoctiall, and somewhat beyond, and holding the thred straight, the numbers of the degrees written vppon the Equinoctiall will shew the longitude of the place.

And if you will know the latitude of that place, or of any other doe thus, Set the one foote of your Compasse in the very pole, extending the other to the place whose Latitude you seeke, and keeping your compasse at that wideneſſe, bring the moueable foote to the first Meridian, whereon the degrees of latitude are marked, and there staying it, the number of the degrees, counting from the Equinoctiall vpward towardes the Pole, will shew the Latitude of the place: As for example, suppose that you would knowe the longitude and latitude of Lisbone, which is a famous towne in Portingale, here hauing first found out that towne in Spaine, which is nigh vnto the Weſt Ocean, extend your thred from the pole through the middeſt of that Towne to the Equinoctiall and somewhat beyond, and you shall finde that the thred will cut the Equinoctiall in the 13. degree, which is the Longitude of Lisbone. Now if you would knowe the Latitude of the same place, set the one foote of your Compasse in the Pole, and extende the other foote to Lisbone, and keeping your Compasse at that wideneſſe bring the moueable foote to the skale of Latitude, and so you shall find that Lisbone hath in North latitude 38. degrees and 30. Now to knowe the distance betwixt any two places doe thus, Set the one foote of your compasse in the one place, and the other foote in the other place, and apply that wideneſſe to the Equinoctiall, and looke howe many degrees of the Equinoctiall that wideneſſe comprehendeth, and by allowing 60. Italian miles to euery degree, you shall haue the distance by a right line betwixt those two places, for by doing thus, you shall finde the distance betwixt Lisbone & Compoſtella to be 120. miles. Thus I haue sufficiently (I hope) expounded euery thing contayned in Plancius his Map, his generall skale made for the same onely excepted, whereof I come now to speake. In this skale are set downe the miles of Ruſſia, of Italie, of England, of Scotland, the French leagues, the lower leagues for Mariners, the Spaniſh leagues, the Germaine and Gaſcoine miles, which two are all one, the

miles of Sweuia in Germany, of Scandia & of Swethland which last three are likewise all one, the vse of which skale is thus. Take with your cõpasse the distance betwixt any 2. places which you desire to know, and apply the same to the skale of such miles as you would know, & so many miles the 2. places shal be distant one from another as the number of the skale doth shew: but if the distance betwixt the 2. places be longer then ỹ skale, then hauing first taken the whole length of the skale with your compasses, looke how many times that wideues of your compasse measuring by a right line is contained in the distance betwixt the two places, and if there bee any odde space left, streigh then your compasse to that odd space, & apply that to the beginning of the skale, and adde the number of miles which you there find to the first great number, so shall you haue the totall summe. And lo here for each an example. First suppose that you would know the distance betwixt Cape S. Marie, & Cape finis terræ, which are two Capes or headlands in the West side of Spaine, both hauing in a manner one selfe Longitude, & do differ only in latitude by 6. degrees, for the one hath 37. & the other 43. in latitude, which distance if you take with your cõpasse by setting the one foote in ỹ one place, & the other foote in the other place and applying that wideues to the skale of Italian miles, you shal find the distance to be 390. Italian miles, but if you measure the same distance according to the Geographicall maner, which is to allow for euery degrée of latitude 60. miels, you shal find the distãce to be no more but 360. Italian miles. Let your other example be thus: Suppose that you would know the distance betwixte Compostella in Spaine and Constantinople, which haue all one Latitude and doe differ onely in Longitude, here because the distance betwixt these two places is longer then the skale, you must take with your compasses the whole length of the skale, and then to looke how many times that wideues is cõprehended (measuring by a right line) betwixt the two said places, & you shall find that wideues to bee cõprehended in the distance betwixt those two places three times, wherefore if you multiply 840. by 3. it will make in all 2520. Italian miles. But if (according to the Geographicall kind of measuring) you doe multiply the difference of their Longitudes, which is 43. degrees, by the number of miles,

which

which is also 43. belonging to the Latitude of both places, which Latitude is also very nigh 43. degrees, you shall find that the distance betwixt those two townes is no more but 1870. Italian miles, which number of miles is not so great as that of the skale by 650. Italian miles. And therefore I can not thinke but that there is some error in the skale committed eyther by the Printer or else by the author through some negligence, and not for lacke of skill or knowledge how to make a true skale, being so excellent a Geographer as the Author by this and other his Maps heretofore made, sheweth himselfe to be. For else there is some greater misterie therein, then I perhaps do understand, for in seeking to know the distance betwixt two places differing onely in Latitude, I find the skale most times to agree with the Geographicall kind of measuring, but if the two places do differ either in longitude onely, or else both in longitude and also in latitude, then I find the skale to differ very much from the Geographicall kinde of measuring. Wherefore I thinke it good briefely here to set downe certaine ready waies of finding out the distance of two places, differing eyther in latitude onely, in longitude onely, or in both, which I doe shew also at large in the second part of my Spheare, Chap. 14.

How to finde out the distance of two places differing only in Latitude.

IF the two places haue both either north or South latitude, then subtract the lesser latitude out of the greater, so shall you haue the difference, which difference if you multiply by sixtie, the product shall be the number of miles, and if to the whole degrees of difference there be annexed any minutes, then you must adde to the product for euerie minute one mile. But if one of the two places haue North Latitude, and the other South Latitude, then you shall finde their difference by addition, and not by subtraction. As for example, suppose that you would know the distance betwixt a towne called

Paſquali, which is the outermoſt towne in Morea vpon the ſea towardes the South, hauing in North Latitude 35. degrees 30. and a certaine towne in Afrique called Debſan ſtanding nigh vnto the lake Zembre, which hath in South Latitude 12. degrees 30. here by adding theſe two latitudes together, you ſhall find the ſumme to be 48. degr. that is the difference of their Latitudes, which difference if you multiply by 60. the product will be 2880. and that is their diſtance.

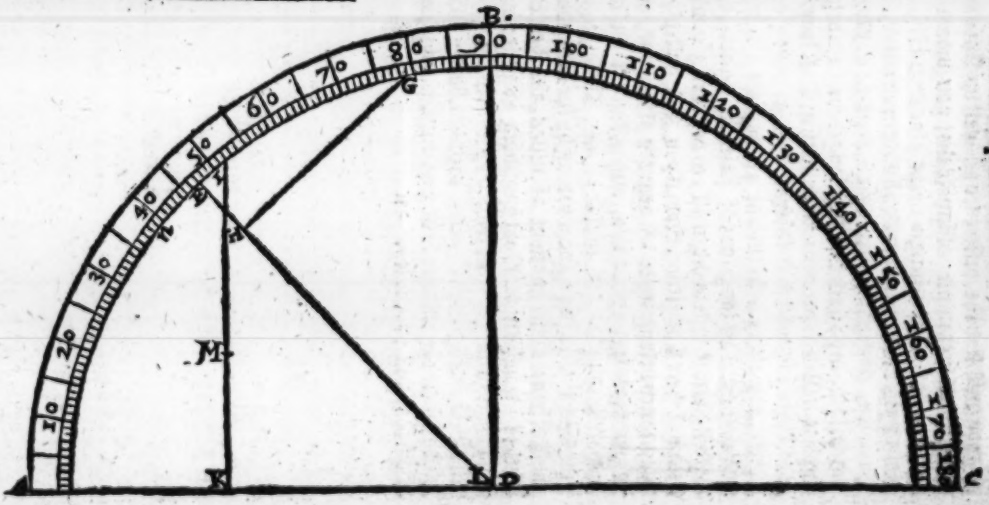
How to find out the diſtance of two places differing onely in Longitude.

IF both places haue either Eaſt Longitude or Weſt Longitude, then ſubtract the leſſer out of the greater, ſo ſhall you haue the difference, which difference you muſt multiply by the number of miles belonging to their Latitude, which you ſhall finde on the Northweſt ſide of the Mappe, or by the Table of miles anſwerable to one degree of euery Latitude ſet downe hereafter in the end of this Treatiſe: and the product thereof ſhalbe the number of miles whereby the one place is diſtant from the other. As for example, I finde Compoſtella in Spaine and Conſtantinople, hauinge both almoſt 43. degrées of North Latitude, to differ onely in Eaſt Longitude, for Compoſtella hath in Eaſt Longitude 13. degrées 30. and Conſtantinople hath in Eaſt Longitude 56. degrées, the difference whereof by ſubtractinge the leſſer out of the greater you ſhall find to be 42. degrées 30. here if you multiply 42. by 43. miles belonginge to one degrée of the foreſaid Latitude 43. you ſhall finde the product to be 1806. then to finde out the value of miles for the fraction 30. by the rule of proportion, you muſt ſay thus: if 60. require 43. miles, what ſhall 30. require, and you ſhall finde in the quotient 21. miles, which you muſt adde to the former ſumme 1806 and it will make in all 1827. miles and ½. which is the true diſtance betwixt the two foreſaide places. But if the one place haue Eaſt Longitude, and the other Weſt Longitude,

then

then you must find the difference as well by Addition as by Subtraction. As for example, suppose that you would know the distance betwixt S. Domingo in the Ile called Hispaniola, and a certaine place in Afrique called Septem montes, nigh vnto the Ocean sea, both places having 18. degrees of North Latitude. And S. Domingo hath in West longitude 310. degrees 30. and the place called Septem montes, hath in East longitud seuen degrees. Here you must first subtract 310. degrees 30. out of 360. degrees, and there will remaine 49. degrees 30. whereunto you must adde the East longitude of Septem montes, which is seuen degrees, and it will make in all 56. degrees 30. which is the difference of their Longitude. Now if you first multiply 56. degrees by 57. miles belonging to 18. degrees of latitude, you shall finde the product to be 3192. miles, and to find out the value of miles for the fraction 30. you must say thus: If 60. require 57. miles what shall 30. require, and working by the common rule of three you shall haue in the quotient 28. miles, and there remaineth $\frac{1}{2}$. which is one halfe mile. Now by adding 28. miles and $\frac{1}{2}$. to 3192 it will make in all 3220. miles $\frac{1}{2}$. and that is the true distance betwixt S. Domingo and Septem montes, but by Plancius skale you shall finde the distance to be 3410. miles, which differeth from the other almost 200. miles.

	Longitude.	Latitude.	
London.	degrees.	degrees.	
Hieruſalem.	22. 0'.	51. 32.	The greater Lat.
The difference of their Longitudes.	69. 0'.	32. 0.	The leſſer Latit.
	47. 0.		



The deſcription and vſe

How

How to finde out the distance of two places differing both in Longitude and Latitude by helpe of a semi-circle deuided into 180. degrees, which I had from my louing friend Maister Wright of Caius Colledge in Cambridge, of whome I make mention as well in my treatise of the Spheare as in that of Nauigation.

FIrst draw a Semicircle vpon a right Diameter, marked with the letters A. B. C. D. whereof let D. be the Centre like vnto this here described, and the greater that such semicircle is, the spaces of the degrees shall be the larger, and thereby the more easie to finde out the minutes. Then hauing drawne your semicircle and deuided the same accordingly, suppose that by helpe thereof you would find out the distance betwixt London and Hierusalem, which two townes doe differ both in Longitude and also in Latitude so much as is here set downe in the front of the figure according to such Longitude and Latitude as Plancius doth allow to eyther towne in his great Map. Now to finde out the true distance of these two townes you must first take the lesser longitude out of the greater so shall you haue the difference of their Longitudes, which is 47. degrees, the count that difference vpon the Semicircle beginning at A. and so proceede to B. and at the ende of that difference, make a pricke marked with the letter E. vnto which pricke draw a right line by your ruler from D. the Centre of the Semicircle: That done seeke out the lesser Latitude which is 32. degrees 0'. in the foresaid Semicircle, beginning to account the same frō the pricke E. and so proceede towards the letter B. and at the ende of the said lesser latitude set downe another pricke marked with the letter G. from which pricke or point draw a perpendicular line, which by helpe of your squire or compasses, may fall with right Angles vpon the former right line drawne from D. to E and where it falleth, there set down a pricke marked with the letter H. That done seeke out the greater Latitude which is 51. degrees and 32. in the fore-

said Demicircle, beginning to account the same from A towards B. and at the end of that Latitude set down another pricke, marked with the letter I. from whence drawe another perpendicular line that may fall by helpe of your squire or compasses, with right Angles vpon the Diameter A.C. and there make a pricke marked with the letter K. That done take with your compasse the distance that is betwixt K and H. which distance you must set downe vpon the said Diameter A.C. setting the one foote of your Compasse vpon K. and the other towards the Centre D. & there make a pricke marked with the letter L. then take with your Compasse the length of the shorter perpendicular line G.H. and apply that wideneſſe vppon the longer perpendicular line I.K. setting the one foote of your compasse at I. which is the end of the greater Latitude, and extend the other foote towardes K. and then make a pricke marked with the letter M. That done take the distance betwixt L. and M. with your Compasse and apply the same to the Demicircle setting the one foote of your compasse in A. and the other towards B and there make a pricke marked with the letter N. And the number of degrees contayned betwixt A. and N. wil shew the true distance of the two places which you shall finde to bee 39. degrees, which being multiplyed by 60. maketh in al 2340. miles and when soeuer you haue any minutes beſides the whole degrees remember to ad vnto the ſumme of degrees for euery minute one mile. By Plancius ſkale you ſhall find the distance betwixt London and Hieruſalem to be 3040. miles which are 700. miles too many. But you haue to note by the way, that if the difference of the Longitudes doth exceede the number of 180. then you muſt ſubtract that exceeding difference out of 360. and the remainder ſhal bee the difference of the Longitudes, and then worke in al points as is before taught.

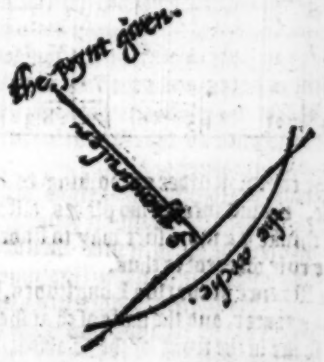
By this rule and the other two rules firſt declared, you ſhall eaſily trie the ſkale of any Mappe whether it bee true or not, ſo as you firſt haue the true Longitude and Latitude of the two places whoſe diſtance you ſeeke to know. And thus I end with Plancius Map, hoping not to offend him with any thing that I haue added thereunto for the better inſtruction of thoſe that haue not beene exerciſed in ſuch matters.

And

And yet I had almost forgotten one thing, which is this, I haue here before as you haue read, made mention of drawing certaine perpendicular lines in the former figure of the Demicircle by helpe of your Compasses. Wherefore I thinke it necessarie here to set downe the order thereof.

How to make with your Compasses, a perpendicular line to fall from any point giuen vpon another right line, making therewith right angles without the helpe of any Squire.

SEt the firme foote of your Compasse in the point giuen, and extend the other foote a little beyond the line right against the point giuen, and draw a secret Arch or portion of a circle that may cut the saide line in two points, and deuide that part of the Arch which lieth betwixt the two sections into two equall parts, setting a pricke in the very midst thereof: then hauing laid your rule to that pricke, and also to the point giuen, draw a right line, and that line will fall vpon the other line with right Angles, as you may see by this figure.



The

The Table of miles answerable to one degree of euerie seuerall Latitude.

D	M	S	D	M	S	D	M	S	D	M	S	D	M	S
1	59	59	19	56	44	37	47	55	55	34	25	73	17	33
2	59	58	20	56	23	38	47	17	56	33	33	74	16	32
3	59	55	21	56	1	39	46	38	57	32	41	75	15	32
4	59	51	22	55	38	40	45	58	58	31	48	76	14	31
5	59	46	23	55	14	41	45	17	59	30	54	77	13	30
6	59	40	24	54	49	42	44	35	60	30	0	78	12	28
7	59	33	25	54	23	43	43	53	61	29	5	79	11	27
8	59	25	26	53	56	44	43	10	62	28	10	80	10	25
9	59	16	27	53	28	45	42	26	63	27	14	81	9	23
10	59	5	28	52	59	46	41	41	64	26	18	82	8	21
11	58	54	29	52	29	47	40	55	65	25	21	83	7	19
12	58	41	30	51	58	48	40	9	66	24	24	84	6	16
13	58	28	31	51	26	49	39	22	67	23	27	85	5	14
14	58	13	32	50	53	50	38	34	68	22	29	86	4	11
15	57	57	33	50	19	51	37	46	69	21	30	87	3	8
16	57	41	34	49	45	52	36	56	70	20	31	88	2	5
17	57	23	35	49	9	53	36	7	71	19	32	89	1	3
18	57	4	36	48	32	54	35	16	72	18	32	90	0	0

Though it be the common order of working to know by helpe of the former table, the distance of two places differing onely in Longitude, yet I thinke it a more sure way to finde it out per Tabulas Sinuum, the rule whereof is thus.

First take the difference of the two Longitudes, by subtracting the lesser out of the greater, and the halfe of that shall be the Arch which you haue to seeke in the front of the Tables, then multiply the sine of that Arch by the sine of the complement of the common

Latitude

Latitude, and deuide the product thereof by the totall sine, the quotient whereof you must seeke out in the Tables amongst the sines and the Arch of that sine is the one halfe of the distance, which bein doubled shall be the whole distance contayning degrees of the great Circle, and euery such degree contayneth of Italian miles 60. and of German miles 15, and by working thus you shall finde the distance betwixt Compostella & Constantinople to be 1846 Italian miles, supposing the common latitude to be 43. degrees, and the difference of their longitudes to be 42. degrees 30. And by working by the common Table you shall finde the distance of those two places to be 1827. Italian miles as before, because the common Table hath no minutes of miles but only seconds, which are not to be accounted of, & in working by Appian his table hauing minutes of miles, you shall find the said distance to be 1892. Italian miles, and by Mercator his Mappe to bee 1980. Italian miles, in whose Map, the common latitude of the said 2. places is 43. & the difference of their longitudes is 44. o'. And by the skale set downe in Plancius his Map, you shall find the distance to bee 2520. Italian miles, in which Map the common latitude of the two foresaid places is 42. degr. 30. and the difference of their longitudes is also 42. degrees 30'. Truly I must needes confesse that it is not so easie to make a skale or trunke for a Map or a Carde drawne in Plano, as for that which is drawne vpon a round body or Globe: & therefore it is no maruaile though the skales of Maps drawne in Plano, and likewise the trunkes set downe in the Mariners Cardes doe not alwaies shew the true distance of places, which I beleeue is to bee done as truely and a great deale more readily by my friend Master Wright his Semicircle before described, then by the rules of Gasparus Peucerus in his booke de dimensione terræ, which rules doe depend vpon the knowledge of the quantitie of the Angles and sides of Spherical Triangles, which kinde of working is indeede more troublesome and tedious then ready or pleasant. But if Maister Wright would make his Demicircle an vniuersal instrument to find out thereby al the three kinds of distances as he promised me to do, there were no way in mine opinion worthie to be compared vnto it, neither for the trueneſſe, easinesse, nor readinesse of working thereby.

A very brief and moſt plaine deſcription of Maſter *Blagraue* his Aſtrolabe, which he calleth the *Mathematicall Iewell*.

Together with diuerſe vſes thereof, *and moſt neceſſarie for ſea men written* by Maiſter *Blundeuill*.



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To the Reader.

OF Astrolabes I haue neuer seene but three sortes, First that of Stoflerus, which for these hundred yeares past or therabouts, hath beene had in most price & estimation, as an instrument contayning all the vses, or at the least the most part of all other Mathematicall Instruments, which because it requireth almost for euery seuerall Latitude a seuerall Table: Gemma Frisius nuented since another kinde of Astrolabe, hauing but one Table to serue for all Latitudes, & therefore he calle d it the *Catholicon*, that is to say, an vniuersall Astrolabe, which hath also beene most esteemed and vsed many yeares. Since whose time, and of very late yeares, one of our owne countrimen a Gentleman of Reading besides London, called M. *Blagraue*, hath greatly augmented the said *Catholicon*, and hath thereby as it were newly inuent ed a third kinde of Astrolabe, which he calleth the Mathematicall Iewell, whereby are to bee wrought more conclusions then by any other one instrument whatsoeuer, for which his most excellent inuention vsed therein, hee deserueth great commendation. And to the intent that others which haue not beene exercised in such things, might the more easily attaine to the better vnderstanding of the said Iewell: I haue made a plaine description

cription of all the parts belonging to the ſaide Iewell, without committing any offence (I hope) to the Author thereof, to the intent that euery Gentleman might haue the perfect knowledge and vſe of ſo worthy an inſtrument. But broade Aſtrolabes though they be thereby the truer, yet for that they are ſubiect to the force of the winde, and thereby euer mouing & vnſtable, are nothing meete to take the altitude of any thing, and eſpecially vpon the ſea, which thing to auoide, the Spaniards do cõmonly make their Aſtrolabes or *Rings* narrow and weightie, which for the moſt part are not much aboue fiue inches broade and yet do waigh at the leaſt foure pound, and to that end the lower part is made a great deale thicker thẽ the vpper part towardes the *Ring* or handle,. Notwithſtanding moſt of our Engliſh Pilots that bee ſkilfull, doe make their Sea Aſtrolabes or *Rings* ſixe or ſeuen inches broade, and therewith very maſsiue and heauie, not eaſie to bee mooued with euery winde, in which the ſpaces of the degrees bee the larger, and thereby the truer, of which kind of Aſtrolabes or *Rings*, I ſhall ſpeake hereafter in my Treatiſe of Nauigation, and alſo of the Mariners Croſſe ſtaffe. But whenſouer you haue to take the altitude of the Sunne or of any other ſtarre bee it wandring or fixed, I woulde wiſh you to vſe the Mariners heauy and maſsiue Aſtrolabe which in mine opinion for that purpoſe, is the fitteſt and moſt aſſured inſtrument of all others; and to find out all other concluſions by helpe of Maiſter *Blagraue* his Iewell, or rather by helpe of the Celeſtial Globe, which for Aſtronomical matters is the perfecteſt inſtrument of al, in which are contained all the ſtars both Southerne and Northerne that haue beene heeretofore knowne, and thoſe that are lately knowne or ſhallbe knowne hereafter may be eaſily

placed

placed therein: which thing cannot bee ſo well perfourmed in any Aſtrolabe were it neuer ſo great. But becauſe the Globe is comberſome and not portable, and therewith coſtly, and eſpecially if it be of any greatneſſe (for the greater the better) and alſo if it chance to be broken in any part of the bodie thereof it can neuer bee made againe perfectly whole, it is therefore no meet inſtrument for euery Mariner to haue, but onely for ſuch as bee of good habilitie, in ſteede whereof to find out many neceſſary concluſions, Maiſter *Blagraue* his mathematicall Iewell may ſerue verie well, and eſpecially if it had on the backe part the like mater and *Rete* or Net, to ſerue to the South Latitude of the world as it hath in the fore parte to ſerue the North latitude, for then I beleeue verily, that the chiefeſt Southerne ſtarres, as the Croſſe, the Southerne Triangle, Noahs Doue or Pigeon, and another called Polophilax, lately found out by ſuch as haue trauelled by ſea on the ſouth ſide of the Equinoctiall, might eaſily be placed by Maiſter *Blagraue* in that *Rete*, hauing once learned of the skilfull Seamen the true longitude, latitude and declination of the ſaide ſtarres, ſo ſhould his Iewel in mine opinion bee much more ſeruiceable to the ſea men, then now it is by reaſon that thoſe few ſouthern ſtars that bee contayned in the firſt Net, are nothing ſo nigh vnto the South pole, as the Northern ſtars deſcribed in his firſt Net, are vnto the North pole, amongſt which Northern ſtars, it were very neceſſarie for the Sea men, that the ſeuē principall Starres as well of the great Beare as of the litle Beare, were all duely Placed in his firſt Nette. Truely if Maiſter *Blagraue* his affaires would ſuffer him to take pain herein, I beleue that his Iewell ſhould not be much inferiour to the celeſtiall Globe, which indeede it repreſenteth, and in ſo doing he ſhould greatly profiit the ſea men,

and deſerue thereby great good wil and commendations at their handes.

What this word Aſtrolabe ſignifieth.

BEfore I beginne to deſcribe vnto you the ſaide inſtrument and all other partes thereof it ſhall not be amiſſe to ſhew you what this worde Aſtrolabe ſignifieth.

This worde Aſtrolabe is as much to ſay as the handle or inſtrument of the Stars, by helpe whereof the manifolde motions and apparences of the heauens and of the Starres therein contayned are knowne, and it is called of ſome a Planiſpheare, becauſe it is both flat and round, repreſenting the Globe or Spheare, hauing both his Poles clapt flat together, the ſhape or figure of which Inſtrument I doe not here ſet downe, becauſe the Inſtrument it ſelfe is to be had for a ſmall price in diuers places of London, which if you lay before you when you mind to reade this my deſcription thereof here following, I doubt not but that you ſhall find euery parte thereof ſo plainely explained as you ſhall neede no other teacher to inſtruct you therein, or to helpe you to vnderſtand any of theſe Concluſions that are to be wrought by that inſtrument, and ſpecially thoſe which I haue here ſet downe, ſuch as the Table following ſheweth, and as I thought moſt meet for ſea men to know, and being throughly exerciſed in them, you ſhall the more eaſily vnderſtand the manifolde and neceſſary concluſions ſet down by Maſter *Blagraue* himſelfe in his own booke, which booke I would wiſh you to buy, and earneſtly to ſtudy the ſame. But now I wil firſt deſcribe the ſaide Inſtrument, and then ſhew the vſe thereof by ſo many concluſions as are contayned in the table hereafter following.

The

The deſcription of M *Blagrave* his Aſtrolabe, otherwiſe called the Mathematicall Iewell.

THis Aſtrolabe is diuided into two partes, wherof the one is called the foreparte, and the other the backe part. The foreparte containeth two principall parts, that is, the Mater, which is vnmoueable, and the Rete which is moueable. Againe, the Mater is enuironed with a great circle, called the Meridian, paſſing through the 2. Poles of the worlde marked with the letters A. B. and through the two Soliſticiall pointes of Cancer and Capricorne marked with the characters belonging to thoſe two Signes, and therefore may very well bee called the Collure of the 2. Soliſtices. And this circle is diuided by two croſſe Diameters into 4. quarters euery quarter containing 90. degrees, ſo as the whole circumference of the circle is 360. degrees, which degrees do proceed from 90. to 90.

Nowe as touching the 2. croſſe Diameters, the one paſſing through the Center, and alſo through the two Poles, is the Arletree of the worke, ſignifying ſometime the firſt Meridian, and ſometime the right Horizon, and ſometime the line of ſixe houres as well for the Morning as Euening, and then it is the line of Eaſt and Weſt, and ſometime the line of North and South.

And the other croſſe Diameter drawne with red inke, ſignifieth moſt commonly the Equinoctiall, and ſometime the line of

East & West, and sometime the line of the North and South, and especially when you haue to finde out the 12. houses of heauen, to which end are set downe in the outermost Meridian these 4. Latine words, first at the North Pole marked with the letter A. Oriens, which is as much to say as the East part: and at the south Pole marked with the letter B. Occidens, which signifieth the West part: and at the end of the ouerthwart Diameter, drawne with red inke, and most commonly signifying the Equinoctiall, marked with the letter C. on the right hand is set downe Culmen Cœli, the highest part of heauen, which is the South, at which end the Ring or handle is fastned. And at the other ende of the saide Diameter, marked on the left hand with the letter D. is set downe Imum Cœli, the lowest parte of heauen, which is the North. And by these two crosse Diameters the whole Mater is diuided into foure quarters, that is, Northeast and Southeast, Northwest and Southwest. The Northeast quarter lyeth betwixt Imum Cœli, and the vpper ende of the Arletree, whereon is written Oriens. And the Southeast quarter lyeth betwixt the same point and Culmen Cœli, and the Southwest quarter lyeth betwixt Culmen Cœli and the lower end of the Arletree, whereon is written Occidens, and the Northeast quarter lyeth betwixt the point Occidens and Imum Cœli.

The meridians and houre lines in the Mater.

Besides these 2. crosse Diameters the Mater is traced with 180 Meridians which doe passe through both the Poles, whereof the first passing through the center from Pole to Pole is the Colure of the Equinoxes, because it passeth through the first point of Aries, and the first poynt of Libra, and is otherwise called the Arletree, and signifieth sometime the right Horizon, and sometime the first Meridian from which vpon the Equinoctiall are counted the degrees of longitude both East and West. And al the foresaide meridians are most commonly vsed as houre lines, for euery 15th. Meridian. counting from the Limbe, doeth signifie one houre, for 15. degrees do make an houre, and 4. minutes doe make a degree. And these houres at the end of euery 15th Meridian are marked in the body of the Mater somewhat aboue the Tropique of Cancer with Arithmeticall Figures. proceeding from 1. to 12. forwarde towardes the right hande, and againe are marked

ked somewhate beneath the Tropique of Capricorne with like Figures proceeding backward towardes the left hand. Whereof the vpper numbers doe signifie the forenoone houres, and the lower numbers the afternoone houres, and are placed so as one selfe houre line doth passe through both numbers: for the line of the eleuenth houre in the forenoone serueth also to the first houre in the afternoone, and the forenoone houre of 10. serueth also to the houre of two in the afternoone, and the forenoone, of 9. serueth to the houre of 3. in the afternoone: and the forenoone houre of 8. serueth to the houre of 4. in the afternoone, and the forenoone houre of 7. serueth to the houre of 5. in the afternoone, and the forenoone houre of 6. serueth also to the 6. houre in the afternoone and from thence forth towardes the left hande, 5. serueth to 7. 4. to 8. 3. to 9. 2. to 10. and 1. to 11. as before.

But whensoeuer you haue to finde out any houre amongst the houre lines in the Mater, remember that the Axletree which passeth through the Center, and also through both the Poles is alwates the sixte houre both of the morning and euening, from which you shall the more easily finde out any houre that you seeke by allowing fifteene Meridians to euery houre, as is before saide. And you haue to note that all these Meridians doe sometime signifie euery one a seuerall oblique Horizon, sauing that the first Meridian or Axletree signifieth the right Horizon as hathbeene saide before. And to finde out in the Mater the horizon of euery latitude, reckon from the axletree on both hands so many Meridians as may make vp the number of degrees of your latitude, and that Meridian shall be your Horizon. In counting of which Meridians you shall finde that euery fift Meridian is drawne with a greater blacke line then the rest. How to find out Horizon euery seuerall latitude

Now ouerthwart these Meridians are drawne 180. Parallels, which proceede from 1. to 90. whose numbers are set downe in the Limbe of the Mater thus, 10. 20. 30. 40. and so forth both vpwarde and downewarde, vntill you come to 90. and these parallels are otherwise called the circles of declination as well of the Sunne as of any star. Amongst which there be 2. Parallels painted red, whereof that towardes the North pole signifieth the Tropique of Cancer, and the other towards the South pole the tropique of Capricorne the Parallels of the Mater.

The two Tropiques

corne. Then there is another oblique ouerthwart redde line, which passing through the Center from Tropique to Tropique, signifieth the Ecliptique line, nigh vnto which on each side are set downe the Characters of the twelue Signes, whereof Aries and Libra are placed at the Center, and Cancer at the one end of the Ecliptique on your right hand, whereas it toucheth the saide Tropique, and Capricorne, at the other ende of the saide Ecliptique, on your left hand, whereas it toucheth the saide Tropique of Capricorne, and the rest of the signes are orderly placed betwixt the said Tropiques, euery two Signes one against another that haue like declination, as Gemini and Leo, Taurus and Virgo, which are placed betwixt the center and Cancer, then Pisces and Scorpio, and Aquarius and Sagittarius are placed betwixt the Center and Capricorne. And euery Signe contayned in the Ecliptique line is diuided with flaunting back streekes into 15. spaces, euery space contayning two degrees, which maketh 180. degrees and being doubled, because the spaces are to bee counted both forward and backward, do make in all 360. degrees, which is the whole circuit or longitude of the Ecliptique, and the degrees of the saide Ecliptique are larger towards the Limbe then towardes the Center, whereby the spaces betwixt Signe and Signe are not equall, but some larger then other some.

And note that vpon the outermost Limbe of the Mater are drawne three circles making two reasonable spaces, both which spaces are diuided into 360. degr. both of them beginning at the North pole. And the degrees in the outermost space of the Limbe beginning at the North pole doe proceede from 15. to 15. downeward towards your left hand, and so round about the instrument vntill you come to 360. which degrees doe shew the houres of the Equinoctiall. And at the North Pole, wheras the diuision beginneth, is set downe the figure of 6. signifying the sixte houre of the forenoone, then counting fifteene degrees downewarde towards your left hand is set down in the foresaid space the figure of 5. then 4. 3. 2. and 1. And at the end of the Equinoctiall on the left hande is set downe 12. from which proceeding still downewardes are set these numbers of houres, 11. 10. 9. 8. 7. and 6. which 6. standeth at the South Pole, then from thence proceeding

ding vpwardes are set downe these houres 5.4.3.2.1. and then 12. which standeth at the end of the Equinoctiall on the right hand from whence proceeding still vpwardes towards the North pole, are set downe these houres, 11.10.9.8. and 7. and at the Pole it selfe is set downe the figure of 6. as before hath been said, from whence you first began to count. And in the inner space of the same Limbe, the 360. degrees are to be counted by 90. in such sort as the first 90. is placed at the North Pole, the second 90. at the one ende of the Equinoctiall, marked with C. The third 90. at the South pole marked with B. And the fourth 90. at the other ende of the Equinoctiall, marked with D. Euery which quarter is to be counted both vpward and downewarde, according as you see the numbers written with Arithmeticall figures, and are placed one aboue another in the said space, wherof the vpper figures are somewhat lesser then the nether figures, both of them proceeding from 1. to 90. the greater figures from the Equinoctiall vpward to the verie Pole, and the lesser Figures from the Pole downewarde to the Equinoctiall, and are thus set downe. 10. 20, 30, 40.

A Description of the Nette, called in Latine Rete.



This parte is first inuironed rounde about with a great circle signifying most commonly the Meridian or 90. Azimuth or Verticall circle, and sometime it signifieth the Equinoctiall, and especially when the Center is taken for the Pole, which Circle is diuided by two crosse Diameters into foure quarters, euery quarter containing 90. degrees, which degrees are to be numbred in the verie Limbe of the Rete both vpwarde and downewarde, and of those two crosse Diameters, the one ende marked with the letter A. signifieth the Zenith, and the other ende marked with the letter B. signifieth the Nadir or point opposite, and

the other crosse Diameter marked with the letter C.D. signifieth the Horizon, which for distinctions sake is otherwise called the Finitor, because the Meridians before described in the Mater are to be called and vsed sometimes as Horizons, and this Finitor is a prety broade Ruler, the very edge whereof is diuided with small diuisions into 180. degrees, which being doubled by reckoning the same both forwarde and backwarde, (beginning at the Center) doe make vp three hundred and three-score degrees.

Finitor

This Finitor signifieth the Horizon of the Globe, the verie edge whereof being diuided by little short streekes into small portions or degrees is alwaies to be applyed to any seuerall latitude when neede is, and the broader part thereof serueth onely to containe the numbers that are sette therein both beneath and aboue to knowe thereby the number of euery Azimuth hereafter described, which numbers doe proceede from the Center to the right hande thus, 10. 20. 30. 40. 50. and so forth to 90. Then backeward towardes the Center are set downe 100. 110. 120. 130. 140. and so forth vntill you come to 180. which is placed at the verie Center. Then from thence towardes the left hande are set downe these numbers 190. 200. 210. and so forth vntill you come to 270. and from thence turning againe towards the center are set downe 280. 290. and so forth vntill you come to 360, placed at the Center.

Almicanterats.

And in the saide Met are certaine circles, which are Parallels to the foresaide Finitor, proceeding towards the Zenith, and are in euerie respect like vnto the Parallels described in the Mater, and these Parallels are called Almicanterats, that is to say, circles of Altitude, which beginning at the Finitor doe proceede to the Zenith, marked with the letter A. from 1. to 90. And though there be cut out in the Rete but 30. Almicanterats, yet for so much as euery space contayned betwixt euery 2, Almicanterats do containe 3. degrees, they make in all 90. for 3. times, 30. maketh 90. which degrees you may see set downe in the Limbe of the Rete on both hands thus, 10. 20. 30. and so forth, till you come to 90. which standeth at the verie Zenith.

Azimuthes.

And these Almicanterats are crossed with other circles called Azimuthes,

Azimuths, that is to say, Meeticall circles, which passing from the Finitor, do meete all in the Zenith, whereof though in this instrument there be set downe but 12. being 15. degrees distant one from another, yet you must imagine that there be 180. which the degrees set downe in the Finitor, in such manner as is before described doe shew. And you haue to note that if the Sunne bee in the verie begmning of the Azimuthes, which is at the Center, then is he full East, and if he be in the 90. Azimuth, then he is full South, and when he is in the 180. then hee is full West, and when he is in the 270. Azimuth, then he is full North.

And if you would haue this account of the Azimuthes to answere the Mariners compasse, then diuide the number of the Azimuthes wherein the Sunne is by 11. degrees and ½ which is 15. minutes, and the quotient will shew the rombe or wind of the Mariners Compasse so as in your account you proceede from the first Azimuth towardes your right hand, that is, from East to South, and from South to West, and from West to North, and so from thence againe to the East point whereas you first began. Also you haue to note by the way, that these Azimuthes doe sometime signifie the circles of position, the vse whereof you shal finde set downe hereafter in the 31. proposition of this Treatise. Howe to count the Azimuths according to the Mariners Compasse.

In the meane time I will proceede in describing the Zodiaque, of the Rete, which in shape is like to an Egge, called in Latine Figura qualis, the one halfe whereof extendeth towardes the Zenith, and the other towardes the Nadir or point opposite to the saide Zenith, in which circle are placed 12. Signes, whereof the 6. Northern signes, that is Aries, Taurus, Gemini, Cancer, Leo and Virgo are placed in the neither halfe towardes the Nadir. and the other sixe Southerne signes, that is, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces, are placed in the vpper halfe of the Zodiaque towardes the Zenith, and euerie one of these signes are diuided into 30. degrees, which are set downe with Arithmeticall Figures in the laid Zodiaque thus, 10. 20. 30. The description of the Zodiaque of the Rete.

Moreouer, in the said Net are placed certain fixed Starres to the number of 71. whose names here do follow. Caput Ophinci, that is the head of Serpentarius, Aquila, the Eagle. Caput Engon, of starres 71. contayned in the Rete,

gon, the head of Hercules. Cuspis Sagittarii, the shaft of Sagittarius. Palma Ophinci, the hande of Serpentarius. Cauda Delphini, the tayle of the Dolphin. Romboides Delphini which is a starre in the Dolphins backe. Cor Scorpionis, the hart of the Scorpion. Frons Borealis, Media, & Australis Scorpionis, the Northerne Southerne, and middle front of Scorpio. Lucida *Lyræ*, the bright Star of *Lyra*, or Vultur cadens. Lanx Chelæ Borealis, & Australis, the North and South starre of the Balance. Corona Gnosiæ, the crowne of Ariadna. Præcedens & sequens caudæ Capricorni, that is, the former and follower in the tayle of Capricorn. Caput Draconis, the head of the Dragon Hastile Bootis, the Bozespeare of Arcturus. Cauda *Cygni*, the tayle of the Swanne. Fomahand, a star in the mouth of the Southerne Fish. Arcturus, a starre betwixt the legges of Bubulcus or Bootes. Humerus Bootis, the shoulder of Bubulcus. Dexter Humerus Cephei, the right shoulder of Cepheus. Crus Pegasi, the legge of the winged Horse. Spica Virginis, the Wheat eare in the hand af Virgo. Tres stellæ in cauda Vrsæ maioris, three starres in the taile of the great Beare. Previndemiatrix, that is Virgo. *Cauda Ceti*, the taile of the Whale. Andromedæ Scapulum, the shoulder blade of Andromeda. Cingulum Andromedæ, the girdle of Andromeda, Humerus Vrsæ maioris, the shoulder of the great Beare. Corui rostrum, the beake of the Crowe. Corui ala dextra, the right wing of the Crowe. Cauda *Leonis*, the tayle of the Lyon. Cervix Leonis, the necke of the Lyon. Cor Leonis, the hart of the Lyon, otherwise called Regulus. Lucida Hydræ, the bright Starre of Hydra. Capita Geminorum, the heades of the two twins named Apollo and Hercules. Cancer, the Crabbe, Canis minor, the little dogge. Canis maior, the great Dog. *Canopus*, a faire starre in the left oare of the Shippe Argus. Humerus dexter Aurigæ, the right shoulder of Auriga. Hircus, the Goate hanging at the backe of Auriga. Hedi, the two little Goates sucking behind at her paps Humerus dexter Orionis, the right shoulder of Orion. Tres stellæ in cingulo Orionis, three stars in the girdle of Orion. Humerus sinister Orionis, the left shoulder of Orion. Pes sinister Orionis, the left foote of Orion. Oculus Tauri, the Bulles eye.

Pleiades

Pleiades. the seuen little starres in the Buls necke. Extremum Eridani, the last end of the flood Eridanus. Caput Medusæ, the head of Medusa. Dextrum latus Persei, the right shoulder of Perseus. Cornu Arietis, the former starre of the Rams horne. Venter Ceti, the bellie of the Whale. Iuba Ceti. the mane of the Whale.

How to knowe which Starr be North or South.

And note that all these starres in the Mette, whose longest tippes or pointes do poynt from the center outward towardes the Limbe, are Northerne starres hauing North declination, and those whose longest tippes do point inward from the Limbe towardes the Center, are Southerne starres, hauing Southern declinacion. All which starres are set downe in a Table in the beginning of his thirde booke, which doth not onely shew their names, but also their longitudes, latitudes, and declinations, their natures, their right ascensions and magnitudes or greatnesse. And whereas both in the Mater, and also in the Rete one selfe Circle is made to haue diuers significations, the cause thereof shall plainely appeare vnto you by the vse of the Astrolabe, in seeking to finde out thereby the Propositions of the foresaide booke.

A description of the label.

And besides the partes before described, there is yet another parte belonging to the foreparte of the Instrument, called the Label, the one ende whereof is fastned to the Center of the Astrolabe, so as it may turne round about, and this Label is diuided into 90. degrees twise set downe therein with Arithmeticall Figures to be reckoned as well from the Center to the point of the Label, as from the point thereof to the Center seruing to diuerse vses, yea the 90. degrees of the Label are sometimes to be repeated 4 times to make vp the number of 360. degrees, as shall hereafter plainely appeare by the 12. proposition, shewing how to finde out the right ascention of any degree or portion of the Ecliptique line.

The fiduciall line of the Label.

And remember that the right line drawne from the Center of the Label alongst the inwarde edge thereof is called the Fiduciall line, and is diuided into 90. small parts called degrees, which line or inward edge is alwaies to be vsed in any proposition, and nat the outward edge or back part of the Label.

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Thus much touching the forepart of M. Blagraue his Iewell, with euery particular part thereof, with which forepart I wish you to bee throughly acquainted before you deale with the propositions here following, or with any other proposition contayned in M. Blagraue his booke.

A briefe description of the backe parte of the said Iewell.

IN the Limbe of the backe part is described the Theorique of the Sun, to know thereby in what signe and degree the Sun is euery day throughout the yere, by laying the Diopter thereto. M. Blagraue calleth it a Ruler, which Diopter is made with two Pinules or square Tablets, each one pearced with two holes, one greater then another, the lesser to take the height of the Sunne by his beame passing through the saide lesser holes, and the greater holes doe serue to take the altitude of the Sunne, being somewhat darkened in the day time, so as hee casteth no beame, or els the altitude of any Starre in the night season by looking with your one eie, the other being shut through the two greater holes of the Pinules or Tablets. And the midest of this Diopter is fastned with a pinne to the Center of the Astrolabe, so as the saide Diopter may turne round about, and the midle line of the said Diopter is called the fiduciall line, because it rightly directeth the sight of the eye to the foresaide holes, the degrees of the altitude of the Sun or of any Star are set downe in the outermost space of the Limbe, diuided by 2. crosse Diameters into foure quarters euery quarter containing 90. degrees, the number of which degrees are set downe in the outermost space of the Limbe of the saide backe parte with arithmeticall figures right ouer the heades of the saide degrees of altitude. And you haue to note, that the perpendicular Diameter signifieth the Meridian, that is, the line of South & north, that is to say, the South point at the ring or handle, and the North at

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the point opposite, and the other ouerthwart Diameter signifieth the right Horizon, that is to say, the line of the East and west, the East being placed on the left hand, and the West on the right hand. And vnder the Theorique of the Sunne you may drawe as many circles of such reasonable distance one from another, as in the spaces thereof may be set downe, the yeares of our Lorde the Dommicall letter for the leape yeare, and the Dominicall letter for the common yeares, the Prime or golden number, the Epact, and on what day of March or of Aprill Easter day euery yeare falleth, in such order as M. Blagraue hath himselfe described in a Table made of purpose in the seconde booke of his Iewell the 11. Chapter.

Thus hauing described euery particular thing as well in the forepart as in the backe part of the said instrument, I will nowe shew you how to vse the same, and howe to finde out thereby all the conclusions contained in the Table here next following.

The Table contayning 32. necessary conclusions to be wrought by this Astrolabe.

FIrst howe to find out the place of the Sunne (that is to say) in what signe and degree thereof the Sunne is euery day throughout the yeare, being not leape yeare, and also the opposite point of that degree. Propolition 1.

How to know the place of the Sunne in the leape yeare, & how to finde the leape yeare. Prop. 2.

How to take the altitude of the Sunne or of any Starre. Prop. 3.

How to take the Meridian altitude, that is to say, the highest or greatest altitude of the Sunne of any starre. Prop. 4.

How to know the altitude of the Sunne at any houre without seeing the Sunne. Prop. 5.

How to know the Meridian altitude of the Sunne or of any starre in the Net without seeing them. Prop 6.

How to know the declination of the Sun, or of any starre contayned in the Net. Prop. 7

How-

How to finde out the latitude of any Region diuers wayes. Prop. 8.

How to know the houre of the day by the Sunne, and alſo in what part or coaſt of heauen he is at that inſtant Prop. 9.

How to find the riſing and ſetting of the Sunne euery day in euery latitude, and thereby the length of the day, and alſo in what coaſt or parte of the Horizon hee riſeth and ſettet h. Prop. 10.

Howe to knowe euery day at what houre the Moone riſeth and ſetteth, and how long ſhe continueth aboue the Horizon and alſo when ſhe is full South. Prop. 11

How to find out the right aſcention of the Sunne, or of any degree or portion of the Ecliptique. Prop. 12.

Another more ready way to find out the right aſcention of any degree or portion of the Ecliptique by the Rete. Prop. 13.

How to finde out the aſcentionall difference of the Sunne or of any degree or point of the Ecliptique. Prop. 14.

How to find out the oblique aſcention of the Sunne or of any point of the Ecliptique. Prop. 15.

How to find out the right aſcention of any Arke or portiõ of the Ecliptique, and therewith to knowe what time it ſpendeth in riſing in a right Spheare. Prop. 16.

How to find out the oblique aſcention of any Arke of the Ecliptique in any latitude, and what time it ſpendeth in his riſing. Prop. 17.

How to find out the oblique deſcention of any point of the Ecliptique in any latitude. Prop. 18.

How to find out the oblique deſcention of any Arke giuẽ of the Ecliptique, and therewith to know the time which it ſpendeth in his ſetting. Prop. 19.

How to know the height of any Starre at any houre without ſeing the ſtarre, and thereby to find out in the firmament all the ſtarres that be deſcribed in the Net, and are to be ſeen with the eye. Prop. 20.

How to find out the aſcentionall difference of anie ſtarre. Prop. 21.

How

How to know the oblique aſcention of any ſtar. Prop. 22.

How to know what ſtars doe neuer riſe nor ſet in any latitude. Prop. 23.

How to knowe at what houre of the day or night any ſtar riſeth or ſetteth. Prop. 24.

How to knowe how long any ſtarre continueth aboue the horizon in euery latitude. Prop. 25.

How to find out the ſtars houre, and thereby to know the houre of the night Prop. 26.

How to find out the diſtance betwixt any two ſtarres contained in the Net. Prop. 27.

Another way to know the diſtance of any two ſtarres, their longitudes and latitudes being firſt knowne, and alſo by that meanes to finde out the diſtance betwixt any two places vpon the earth. Prop. 28.

How to find out the degree of *Medium Cœli* at any houre of the day, that is to ſay, the degree of the Zodiaque that is in the Meridian at any houre that you ſeeke, and alſo the degree called *Imum Cœli*. Prop. 29

How to find out the horoſcope or aſcendent at any time of the day or night and thereby to haue the foure principall angles of heauen: Prop. 30.

How to find the circles of poſition, & to know how much the Pole is eleuated aboue euerie ſuch circle in anie latitude, without the knowledge whereof you cannot find out the 12. houſes by this Aſtrolabe. Prop. 31.

How to finde out all the 12. houſes of heauen, and thereby to erect a figure at any houre of the day or night. Prop. 32.

The vſes of the Aſtrolabe, and firſt howe to find out the place of the Sun is (that is to ſay) in what ſigne and degree thereof the Sun is euery day throughout the yeare, being not leape yeare, and alſo the oppoſite point of that degree.

Propoſition. 1.

LAy the Diopter which is on the backſide of the Aſtrolabe vpon the day of the moneth, and that ende of the Diopter with his fiduciall line will ſhewe you in what ſigne and degree thereof the Sun is that day, and the other ende of the Diopter will ſhewe you the oppoſite point to that degree, as for example: I would knowe the place of the Sunne the 17. of July, here by laying the Diopter vpon that day, I finde the Sunne to be in the fourth degree of Leo, and the oppoſite point thereof to be the fourth degree of Aquarius.

How to knowe the place of the Sunne in the leape yeare, and how to finde the leap yeare,

Propoſition. 2

WHen it is leape yeare you muſt alwayes adde one degree more euery day during that yeare vnto the place of the Sunne found by the firſt propoſition, which leape yeare you ſhall knowe by diuiding the yeare

yeare of the Lord by 4. for if there be no remainder left, then that yeare is leape yeare, so shall you find the yeare of our Lord 1596. the be leape yeare.

How to take the altitude of the Sunne, or of any starre.

Proposition. 3.

TO take the altitude in any time of the day when the Sunne shineth, you must turne your face and also the left Tablet or Pinule of the Diopter towardes the Sunne, holding the Astrolabe by the ring with your right forefinger or middle finger being somewhat bowed, in such sort as the Astrolabe may hange plumbe, and then with your left hand lift the Diopter vp and downe vntil the Sun with his beame do iustly straike through both the holes of each Pinule of the Diopter, so as you may see the shadow of the two holes of the vpper Pinule to play vpon the two holes of the nether Pinule, then marke vpon what degree of altitude the thinnest edge or Fiducial line of the Diopter falleth in the outermost skirt or border of the backe of the Astrolabe, for that is the Sunnes altitude for that present But if the Sunne be couered with a cloud, so as it shineth not cleare inough to cast any shadow, & yet so as it may be seene with the eye, then hang the Astrolabe by the ring vpon your right thumbe, and turning your face towardes the Sunne, lift vp your hand with the Astrolabe so heigh, as by mouing the Diopter with your left hand vp and downe, you may with your right eye (the other being shut) see the Sunne through the greater holes of both the Pinules of the Diopter, and marke vpon what degree of altitude the vpper end of the Diopter falleth, and that is the altitude of the Sunne at that time, and in this manner you must also take in the night season, the altitude of any starre.

How to take the Meridian altitude, that is to ſay, the higheſt or greateſt altitude of the Sunne or of anie ſtarre.

Propoſition. 4.

GEe into ſome open place whereas the Sun ſhineth ſomewhat before noonetide, and there hanging the Aſtrolabe vppon your right forefinger or middle finger, take the altitude of the Sunne in ſuch manner as is before taught, at diuers times with ſome pawſe betwixt euery time to know thereby whether ſuch altitude increaſeth or decreaſeth, for if it increaſeth, then the Sunne is not yet at the Meridian, but if it decreaſeth, then it is paſt the Meridian, and therefore you muſt watch diligently to take him when he is at the higheſt. And you muſt do the like to take in the night ſeaſon, the Meridian altitude of any knowne ſtarre, ſauing that then you muſt hange your Aſtrolabe vppon your thumbe before your right eye, and to doe as is taught in the laſt Propoſition.

How to know the altitude of the Sun, or of any ſtar at anie houre of the day without ſeeing the Sunne or ſtarre.

Propoſition. 5.

SEt the Finitor at your Latitude, and ſeeke out amongſt the houre lines or Meridians of the Mater in what point the Parallel or Circle of declination of the Sunne crolleth the houre line which you ſeeke, and the Almicanterath and Azimuth paſſing through that point doe ſhew both the altitude and alſo the coaſt or part of heauen, wherein the Sunne or ſtarre is at that inſtant. This is a very neceſſarie Propoſition, for by knowing the height of the Sunne at euerie houre

houre of the day in whatsoeuer signe the Sunne is, you may make Tables for particular Dyals, as Cylinders, houre Quadrants, and such like to serue any Latitude, yea rather this Instrument (as Maister Blagraue rightly sayth) is a Table of it selfe ready made to serue such purposes. Let the example of this Proposition be thus, Suppose that at eight of the clocke in the morning the 21. of Aprill 1592. the Sunne being then in the tenth degree of Taurus, and his declination 15. degrees Northward, you would knowe the altitude of the Sunne at that houre, which by working as the rule teacheth, you shall finde to bee 30. degrees and that he is about 16. degrees distant from the East towardes the South.

How to knowe the Meridian altitude of the Sunne or of any starre euery day throughout the yeare, without seeing eyther Sunne or star.

Proposition. 6.



I Will seeke to knowe the declination of the Sun or star eyther by the seuenth Proposition next following, or else by some table, and whether it be North or South, & knowing his declination, bring the Finitor to your Latitude, and staying it there seeke out in the limbe of the mater on your right hand the said declination, and there marke what Almicanterath toucheth that point, for that Almicanterath being counted vppon the limbe of the Rete from the Finitor, doth by and by shew the Meridian altitude of the Sunne or starre for that day. As for example, I would know the Meridian altitude of the Sunne the first of July 1592. at which time his Parallel or declination is 22. degrees and certaine minutes Northward. Here hauing layde the Finitor to the Latitude 52. I finde that the 60. Almicanterath toucheth the Parallel and that is the Meridian altitude of the Sunne that day. Againe suppose that I would know the Meridian altitude of the starre Oculus Tauri, in

the Latitude 52. Here hauing brought the Pinitor to the ſaide latitude, I finde that the 53. Almicanterath toucheth his Parallell or declination, which is 15. degrees 49. Northward, ſo as I finde his Meridian altitude in that latitude to be 53. degrees. But you haue to note that if the ſun or ſtar haue ſouth declination, then you muſt count his parallel from the Equinoctial downward towards the ſouth Pole, ſo ſhall you find the Meridian altitude of the great dogge called Canis maior, whoſe Southerne declination is 16. degrees to be 22. degr. & 30. And by knowing the Meridian altitude of any ſtar, you may alſo know how farre he is diſtant from the Meridian or South line: if you ſubtract from his Meridian altitude his altitude taken at any other time of the ſame night, for the remainder will ſhew his diſtance from the Meridian, & if the ſtarre at the time of taking his altitude, be in the Eaſt part of the firmament, then he is ſo much ſhort of the Meridian, and if he bee in the Weſt, then he is ſo much paſt the Meridian. As for example, knowing the Meridian altitude of Oculus Tauri to be 53. degrees, and his other altitude newly taken to be 30. deg. I find his diſtance from the Meridian to be 23. deg. aſwell by ſubtraction, as by counting vpon the limbe of the Rete the degrees contained betwixt the two foreſaid Almicanteraths. And becauſe the ſaid ſtar was in the Eaſt part of the firmament when I tooke his altitude, I conclude that he wanted 25. degrees of arriuing to the Meridian which maketh one houre and a halfe, and a little more.

How to finde the declination of the Sunne or of any ſtarre deſcribed in the net.

Propoſition. 7.

THis may be done two manner of waies, firſt knowing the place of the Sunne, ſeeke his place in the Ecliptique line of the mater, and looke what Parallel of the Mater paſſeth through that degree, and the number of that Parallel will ſhew the declination (that is to ſay) how farre the Sunne is diſtant from the Equinoctiall, counting from the Equinoctiall vp-

on

on the outermoſt Meridian or inner limbe of the mater, and according as the ſigne wherein the ſunne is, be it Northerne or Southerne, ſo is the declination of the ſunne, and muſt be counted eyther vpwarde or downewarde accordingly. The ſeconde way is thus, bring the Fiduciall line of the Labell to the degree of the ſunne in the Zodiaque of the net, and the number of degrees counted vpon the labell betwixt the limbe of the net, and the place of the ſunne which the labell toucheth vpon the outward edge of the ſaide Zodiaque, will ſhew his declination. By eyther of theſe two wayes you ſhall finde the declination of the Sunne, being in the tenth degree of Taurus to be 15. degrees Northward. And by this laſt way you may know the declination of any ſtarre contayned in the net thus. Hauing founde in the net the ſtar whoſe declination you ſeeke, lay the Fiduciall line of the labell to the longeſt tippe of that ſtarre, then count vpon the labell how many degrees are contayned betwixt the limbe of the Rete, and that point whereas the labell toucheth the longeſt tippe of the ſaide ſtarre, and that ſhalbe his declination eyther Northerne or Southerne according as the ſaide tippe pointeth either outward or inward. for if outward from the Centre, then it is Northerne, if inward towards the Centre, then it is Southerne, as hath beene ſaide before in the deſcription of the Net, and by doing thus you ſhall finde that the ſtarre called Canis maior, that is the greater dog, hath in South declination 15. degrees 55. Againe you ſhal finde the firſt ſtarre of the Rams horne called Cornu Arietis to haue in North declination 18. degrees.

How to finde out the Latitude of any Region.

The 8. Propoſition.



Firſt you muſt know the place of the ſun, and alſo his declination, and hauing taken his Meridian altitude, reckon the ſame amongſt the Almicanterathes, from the Finitor vpwardes, and turne about the Rete from the Pole Arctique towards the Equinoctiall on your right hand, vn-

till it toucheth the Parallel of the ſunne, for then looke on your left hand, and you ſhall finde the Finitor to ſtande at that Latitude which you ſeeke. As for example, the 12. of Aprill 1591. the ſun being in the firſt degree 20. minutes of Taurus, and his declination being then 12. degrees Northward, I finde his Meridian altitude to be 50. degrees, which I count vpon the limbe of the Rete proceeding from the Finitor vpwards towards the Zenith, and then I turne the Rete vntill I haue brought that Almicanterath to the Parallel of the Sunne, which is 12. degrees, counting the ſame from the Equinoctiall on the right hande of the mater towardes the North Pole, and there ſtaying the Rete, I finde that on the left hande the Finitor lyeth vppon the 52. degree of Latitude counting from the North Pole downe towardes the Equinoctiall. The common way of finding the latitude is thus, if it be in the day time, then take the Meridian altitude of the Sunne, and if the Sunne be in any of the ſix Northerne ſignes, then ſubtract the declination of the ſunne out of his Meridian altitude and the remainder ſhall be the altitude of the Equinoctiall aboue your Horizon, which being taken out of 90. the remainder will ſhew the altitude of the Pole, but if the ſunne be in any of the ſix Southerne ſignes, then you muſt adde his declination to his Meridian altitude, and the ſumme thereof ſhall be the altitude of the Equinoctiall which being taken out of 90. the Remainder will ſhew the Latitude or eleuation of the Pole. But to know the latitude of any place in the night ſeaſon, you muſt take the Meridian altitude of ſome knowne ſtarre which both riſeth and ſetteth then after that you haue taken his Meridian altitude with your Aſtrolabe, you muſt learne to know his declination, and whether it be Northerne or Southerne, for if the ſtarre haue north Declination, then you muſt ſubtract his declination from his Meridian altitude, and the remainder ſhall bee the Altitude of the Equinoctiall, which being taken out of 90. ſhall bee the altitude or eleuation of the Pole, but if the declination of the ſtar be Southernely, then you muſt adde his declination to his Meridian altitude, and that ſumme ſhall be the altitude of the Equinoctiall, which being taken out of 90. the remainder ſhalbe the eleuation of the Pole. And there be diuers other wayes of finding out the latitude

of

of any place, which I haue partly ſet downe in my treatiſe of the two Globes about the latter ende thereof, and partly in my Treatiſe of Nauigation, whereas I ſpeake of the Northſtarre and of his guardes.

How to know the houre of the day by the Sunne, and alſo in what part of heauen he is at that inſtant.

Propoſition. 9.

TAke the altitude of the Sunne, and knowing the latitude of the place where you are, bring the Finitor of the Rete to that latitude, and hauing ſtaied it there, looke in what point the Almicanterath or altitude of the Sunne crolleth the Sunnes Parallel or Circle of declination in the mater, and the houre line paſſing through that point will ſhew the true houre, and at that inſtant you may alſo know in what Azimuth (that is to ſay) in what part of heauen, or as the Mariners tearme it in what rombe or winde, as Eaſt, Weſt, North, or Southe. the Sunne is at that inſtant. for that Azimuth which paſſeth through the foreſaide pointe, is the Azimuth of the Sunne. As for example, the 21. of Aprill 1592. the ſunne being in the tenth degree of Taurus, and his declination being then 15. degrees Northward, I find by the Aſtrolabe, Quadrant or Croſſe-ſtaffe, the altitude of the Sunne in the forenoone to bee 30. degrees. Wherefore I haue laide the Finitor to my latitude which is 52. and ſtaied it there, I marke in what point the Almicanterath cutteth the ſunnes foreſaide Parallel in the mater, and I finde that the houre line of eight in the forenoone cutteh that point, which ſheweth that it was then eyght of the clocke in the morning, and that the ſunne was about 15. degrees diſtant from the Eaſt towardes the South.

How to find the rising, and setting of the sun euery day in euery Latitude, and thereby the length of the day, & in what coast or part of the Horizon he riseth and setteth.

Proposition. 10.

BRing the Finitor to your Latitude and staying it there, looke in the Mater where the Parallel of the Sunne doeth cut the Finitor, and the houre line which crosseth that point, will shew the houre of his rysing and setting, and the number of houres betwixt his rysing and setting is the length of the day, and the number of the Azimuthes betwixt that point of the Finitor, and the Centre or first Azimuth will shew you in what parte or coast of the Horizon he both ryseth and setteth. As for example, seeking by this rule to know at what houre the sunne riseth the 19. of June 1592. hee being then in the first degree 39. minutes of Cancer, and his declination then 23. degrees 1′9. I find that he riseth 12. minutes before foure, and goeth downe 12. minutes after 8. and thereby I finde the length of the day, counting from sunrise to sunne set to be 16. houres and 24. minutes, and that he riseth from the East towards North 40. degrees, which according to the Mariners rekoning is Northeast and by East two quarters and somewhat more towards the North.

How to know euery day at what houre the Moone riseth and setteth, and how long she continueth aboue the Horizon and also when she is full South.

Proposition. 11.

FIrst you must learne by some Almanacke or Ephemerides, in what signe and degree the Moone is, and whether it bee a Northerne signe or Southerne signe, for if she be in a Northerne signe, then bring her place to the

the Horizon of your latitude in the northeast part of the Astrolabe but if she be in a Southerne signe, bring her place to the said Horizon in the Southeast parte of the Astrolabe, and there hauing staied the Rete bring the labell to the place of the Sunne for that day, and the labell will point to the houre of the Moones rising in the limbe of the Mater: but because the Almanack or Ephemerides doe not set downe the true place of the Moone but onely at noone, you must therefore consider whether it be in the forenoone or in the afternoone that you seeke, for if it be in the afternoone you had neede to know how many houres are run from noone, and then for euery houre, to adde halfe a degree to the place of the Moone which you found at noonetide, but if it be in the forenoone, then you must subtract from her place at noone, for euery houre halfe a degree, so shall you go very nigh to finde her true place in the Zodiaque for that houre, though you know not her latitude which is but 5. deg. at the most, and therefore can cause no great error in this mater. Now to know when she setteth you must do thus, if the Moone be in any Northern signe, then you must bring her place to the foresaid Horizon in the Northwest part of the Astrolabe, & by laying the labell to the place of the Sunne, it wil point to the houre of her setting, but if she be in any Southerne signe, you must bring her place to the Horizon in the Southwest part of the Astrolabe, & the labell being laid to the place of the Sun wil point to the houre of her setting. Now if you would know how long time she is aboue the Horizon, and also at what houre she is full South, then count the houres betwixt the rising and setting, and that shal be the time of her continuance aboue the Horizon, and the verie middest of that is the true houre that she is full South. As for example, the fourth day of September 1592. in the latitude 52. at nine of the clock at night the Sunne being in the 21. degrees 47. of Virgo or there abouts, and the Moon being in the 2. degree 30. of Capricorne, I am desirous to know when the Moone did rise that day, and by working according to the rule before set downe, I founde that she did rise about three of the clocke in the afternoone, and that she went downe at tenne of the clocke at night and halfe an houre past, and that she was full South or at the Meridian a little before seuen of the clocke in the afternoone. And as by this rule you

may

may finde out the time of the rising and setting of the Moone, so may you finde the time of the rising and setting of the other fiue Planets, that is Saturne, Iupiter, Mars, Venus, and Mercury, any day throughout the yeare, so as you know their places in the Zodiaque, which the Ephemerides of Stadius doth shewe, not onely at noone tide, but also at any other houre of the day by helpe of certaine Tables made of purpose, the vse of which Tables I haue set downe in the latter end of my Treatise of the two globes.

How to find out the right ascention of the Sun, or of any degree or portion of the Ecliptique.

Proposition. 12.

TAke the Rete & the label cleane from the Astrolabe, and seeke out in the Ecliptique line of the mater the signe and degrée whose right ascention you would know, and marke what meridian cutteth that point: that done, place the label vpon the pinne which standeth in the very Centre of the Iewell, and make the fiuciall line thereof to lie right vppon, and alongest the Equinoctiall line eyther towardes your right hand or towardes your left, according as the signe & degrée whose ascention you seeke is placed in the mater. Then marke where the foresaid Meridian cutteth through the label, and also through the Equinoctiall line and the number of degrees contayned in the label, betwixt the Centre and that point of the Equinoctial is the right ascention of that degree of the Ecliptique which you seeke, which number of degrees you must count vpon the label in this maner For if that signe and degree be contayned betwixt the first point of Aries and the first point of Cancer, then you must begin to count vpon the label at the Centre, and so proceede forwarde towards Cancer, the right ascention of whose first point is 90. degrees, but if the signe and degree which you seeke, bee betwixt the beginning of Cancer, and the beginning of Libra, which is at the very Centre right against Aries, then you must count vpon the

the labell backwarde from 90. to 180. by adding to euery tenth ſpace of the labell 10. degrees, ſo as the firſt number proceeding towards your left hand ſhall be 100. and next to that 110. and ſo forth vntill you come to 180. which is the right aſcention of the firſt point of Libra, and from Libra you muſt count toward Capricorne 190. then 200 and ſo forth till you come to 270. which is the right aſcention of the firſt pointe of Capricorne: and from thence you muſt count 280. 290. then 300. and ſo forth towards the Centre vntil you come to 360. which is the right aſcention of the laſt point of Piſces, ſo as though there bee ſet downe in the labell but 90. degrées both forward and backewarde, yet 90. being foure times repeated, doe make in all 360. which is the whole Longitude of the Equinoctiall. As for example, you would know perhaps the right aſcention of the tenth degree of Sagittarius. here by ſeeking in the mater you ſhall find that the Meridian paſſing through that degree will cut both the labell being layde towards your left hande, and alſo the Equinoctiall in the 248. degrees 21. minutes, which is the right aſcention of the tenth degree of Sagittarius, in counting whereof remember to beginne from 180. that is from the Centre, and this aſcention agreeth with the Table of right aſcentions ſet downe in Stadius his Ephemerides the 44. page of his booke. Againe in ſeeking to know the right aſcention of the 10. degree of Taurus, if you beginne to count vpon the labell from the Centre, which is the firſt point of Aries, you ſhall finde that the Meridian which paſſeth through the 10. degree of Taurus will cut the labell, and the Equinoctiall line in the 37. degree 35.

Another more rady way to find out the right aſcention of any degree or portion of the Ecliptique by the Rete.

Propoſition. 13.

LAy the Finitor euen with the Arietree, ſignifying here the right Horizon, ſo as the firſt point of Aries may meete with the Eaſt point of the ſaid Horizon, and lay the labell right vpon and alongeſt the Equinoctiall line, eyther towardes Cancer or towardes

wards Capricorne, according as the signe and degree which you seeke is placed in the Ecliptique of the Water, and marke therewith what Meridian passeth through that degree, and follow the same vntill it cutteth the Equinoctiall, and also the label lying thereon: and by counting vppon the label the number of degrees to that point in such order as is before taught, you shall haue your desire. As for example, if you seeke to knowe the right ascention of the tenth degree of Leo, here hauing placed the Finitor as before is taught, seeke out in the Water what Meridian passing through that degree cutteth the said Equinoctiall, & in what point, & lay the label to the said Equinoctial according as the signe requireth, be it towardes Cancer or Capricorne, & by counting the degrees vpon the labell as is before taught, that is from 90. proceeding from the limbe backeward towardes the Centre, you shall finde the right ascention of the 10. degree of Leo to bee 132. degrees, which differeth from the foresaid Table but 2′7. a thing of small moment considering the narrowe spaces of the Meridians in the Water.

How to find out the ascentional difference of the Sunne, or of any degree or point of the Ecliptique.

Proposition. 14.



RIng the Finitor to your latitude, and there staying it, looke amongst the Meridians in the Water in what pointe the Parallel of the Sunne cutteth the Finitor, and the number of the Meridians contained betwixt the Arletree, and that point shalbe the ascentional difference. As for example, in the Latitude 52. I would knowe the ascentionall difference of the Sunne being in the fourth degree of Cancer, at which time his Parallel of declination is 23. degrees Northward, here by working according to the rule I finde the ascentionall difference to be 33. degrees 3′9.

How

How to finde out the oblique aſcention of the Sunne or of any point of the Ecliptique.

Propoſition. 15.

HAuing found the right aſcention and alſo the aſcentionall difference by the former Propoſitions, conſider whether the declination of the Sunne or of any other point of the Ecliptique be Northor South, for if it be North, then ſubtract the aſcentionall difference out of the right aſcention, and the remainder ſhall be the oblique aſcention. But if the declination bee South, then adde the aſcentionall difference to the right aſcention, and the ſumme thereof ſhal be the oblique aſcention. As in the former example knowing the declination of the Sunne to be 23. degrees Northward, I ſubtract the aſcentionall difference which was 33. degrees 30. minutes out of the right aſcention of the Sunne, which was 94. degrees, and there remaineth 60. degrees 30. which is the oblique aſcention of the Sun being in the fourth degree of Cancer, and his declination being 23. degrees Northward as is before ſuppoſed.

How to find out the right aſcention of any arke or portion of the Ecliptique, and therewith to knowe what time it ſpendeth in ryſing in a right Spheare.

Propoſition. 16.

BRing the ende of the given Arke found out in the Zodiaque of the Rete, vnto the left end of the Equinoctiall marked with D. and there ſtaying it, laye the Fiduciall line of the labell vpon the beginning of the ſaide Arke, and the number of degrees in the innermoſt limbe of

of the Mater contained betwixt the left ende of the Equinoctiall and the Fiduciall line of the labell ſhall bee the right aſcention of that Arke, and the houre ſet downe in the outermoſt limbe whereunto the labell pointeth, ſhall be the time which the ſaid Arke ſpendeth in his riſing, ſo ſhall you finde the Arke of the whole ſigne Taurus to be 30. degrees, and to ſpend in his riſing two houres

How to find out the oblique aſcention of any Arke of the Ecliptique in any Latitude, and what time it ſpendeth in his ryſing.

Propoſition. 17.

FInd the oblique aſcention both of the beginning and ending of the Arke by the 15 Propoſition, then ſubtract the ſaide aſcention of the beginning of the Arke out of the aſcention of the ending of the ſaide Arke, alwayes remembring that if the oblique aſcention of the beginning be greater then the other, then to add to the leſſer 360. and out of that ſumme make your ſubtraction, for the remainder ſhall bee the oblique aſcention of the whole Arke, then count the number of that aſcention in the innermoſt limbe of the Mater beginning at the left ende of the Equinoctiall marked with D. and ſo proceede vpwarde towards your right hand, and where the ſaid aſcention endeth, there lay the labell, and the houre whereunto the labell pointeth ſheweth the time which the ſaide Arke ſpendeth in his ryſing in that Latitude. As for example, I would know the oblique aſcention of the whole Arke of the ſigne of Taurus, and what time that Arke ſpendeth in his ryſing: firſt here hauing found the oblique aſcention of the firſt point of Taurus to be about 13. degrees in the Latitude 52. and the oblique aſcention of the laſt point of that ſigne to be about 30. here by taking 13. out of 30. there remaineth 17. degrees, which is the oblique aſcention of the whole Arke of the ſigne Taurus, which 17. degrees

I count

I count in the limbe of the mater from the end of the Equinoctiall marked with D. vpward, and there laying the label, I finde that it pointeth to one houre and two degrees, which maketh 17°. so as I conclude thereby that the whole Arke of the signe Taurus, spendeth in his oblique ascention one houre and eight minutes.

How to find out the oblique descention of any point of the Ecliptique in any Latitude.

Proposition. 18.

HAuing found out the oblique ascention of the poynte opposite to the point giuen, adde thereunto 180. degrees, and the summe thereof shall be the oblique descention of the point giuen, alwaies remembringe if the summe of addition doe exceede 360. to subtract out of that summe 360. and the remainder shall be the descention of the point giuen. As for example, you would know the oblique descention of the first point of Taurus, whose point opposite is the first point of Scorpio, and his oblique ascention according to Reynholdus his Tables is 222. degrees 36. minutes, whereunto if you adde 180. you shall make the totall summe to be 402. degrees 36. minutes, from which summe if you subtract 360. degrees according to the rule before giuen, there will remaine 42. degrees 36. minutes, which is the oblique descention of the first point of Taurus.

How to find out the oblique descention of any Arke giuen of the Ecliptique, and therewith to knowe the time which it spendeth in his setting.

Proposition. 19.

HAuing found the oblique descention of the beginning, and also of the ending of the giuen Arke by the last proposition subtract the descention of the beginning out of the descention of the ending, and the remainder

der shall be the oblique descention of the giuen Arke, alwayes remembring if the subtraction cannot bee made to add thereunto 360. that done diuide that by 15. and the quotient will shew the number of houres which the giuen Arke spendeth in his setting: and remember that if in making that diuision there be anye remainder left, to multiply that remainder by foure, and so you shal haue the minutes. By working thus you shall finde the oblique descention of the whole Arke of Gemini to bee 36. degrees 49. minutes, and in the Latitude 52. to spend in his going downe two houres and 24. minutes.

How to know the height of any star at any houre, without seeing the starre, and thereby to find out in the firmament all the starres that bee described in the net, and are to bee seene with the eye.

Proposition. 20.

LAy the label to the houre supposed vppon the limbe of the Mater, and then bring the place of the Sunne for that day to the Fiduciall line of the label, and there hauing stayed the Rete, bring the Fiduciall line of the label to the tippe of the starre whose altitude you seeke, and the label will shew you upon the limbe of the Mater how many degrees that starre is distant from the South. Againe by counting vpon the label, the degrees contined betwixt the point of the label, & the tip of the said star you shal haue his declination, which is North or South according as the starre is Northerne or Southerne. Then bearing in minde as well the stars distance from the South, as also his declination worke thus, Bring the Finitor to your Latitude, and vpon the stars Parallel or Circle of declination in the Mater Count from the limbe of the Mater the distance of the starre before found, and mark what Almicanterath crosseth that point, for there is the altitude of the star at that instant, and the Azimuth which cutteth that point, sheweth

in

in what part or coast of heauen the starre is at that present. And remember to seeke the Parallel of the starre on that side of the Mater either on your right or left hand, so as it may fall amongst the Almicanterathes, for otherwise you shall not finde that you seeke. As for example the 26. of October 1591. at nine of the clock at night, you would know the height of the first star of the Rams horne called Cornu Arietis the Sunne being then in the 12. degrees and 12. minutes of Scorpio. Here after that you haue laide the labell to the houre supposed, and brought the degree of the Sunne for that day to the Fiduciall line of the labell, and staied the Rete there, bring the labell to the tippe of the starre in the Rete, and the labell will shew in the limbe of the Mater how many degrees the starre is distant from the South, which you shall find to bee 28. degrees and 30. minutes, and the declination of the saide starre being counted vpon the saide labell, to be 18. degrees, then keeping these two numbers in minde, bring the Finitor to your Latitude supposing the same to bee 52. degrees, and there staying the Rete, seeke for the Parallel of the starre which is 18. degrees on your right hand, and vpon that Parallel count by the Meridians from the limbe inward, the starres distance from the South, which is 28. degrees 30. minutes, and you shall finde that the 49. Almicanterath cutteth that point, so as you may conclude that the altitude of the starre called Cornu Arietis, was at that houre 49. degrees, and that the 47. Azimuth doth also passe through that point which sheweth that the starre is 47. degrees from the East towardes the South, which according to the Mariners accountes is Southeast, and somewhat more to the Southward. Now to find out the said starre in the firmament, if it bee a star light, you haue no more to doe but to lay the Diopter of your Astrolabe at that altitude, and to turne your face towardes that coast (that is to say) Southeast and somwhat more to the Southward, and the next bright starre which answereth in that coast to that altitude is the starre which you seeke.

How to finde out the aſcentionall difference of any ſtarre.

Propoſition. 21.



RIng the Finitor to your Latitude, and ſtaying it there, looke in what point the Parallel of the ſtarres declination cutteth the Finitor, and the number of the Meridians contained betwixt that point and the Centre, is the aſcentionall difference, ſo ſhall you finde the aſcentionall difference of the Buls eye called Oculus Tauri, whoſe declination is 15. degrees 4′8. to be 21. degrees.

How to know the oblique aſcention of any ſtarre.

Propoſition, 22.



IF the declination of the ſtar be Northern, ſubtract the aſcentionall difference out of the right aſcention, & the remainder ſhall be the oblique aſcention of the ſtarre, but if his declination be Southerne you muſt ad the aſcentionall difference to the right aſcention, and that ſhal be the oblique aſcention of the ſtarre. As for example, becauſe Oculus Tauri is a North ſtarre, ſubtract his aſcentionall difference which is 21. degrees, out of his right aſcention which as the foreſaid Table ſheweth is 62. degrees 3′0. and there will remaine 41. degrees 3′0. which is the oblique aſcention of the ſaid ſtarre. But if it were a South ſtarre as Spica Virginis, whoſe declination is almoſt 9. degrees Southwarde and her aſcentionall difference is 11. degrees 3′0. then you muſt ad the aſcentionall difference to her right aſcention, which is 195. degrees 5′1. ſo ſhall you finde her oblique aſcention to bee 207. degrees 2′1.

How

How to knowe what ſtarres doe neuer riſe nor ſet in any Latitude.

Propoſition. 23.

IF the ſtarre be a Noꝛth ſtarre hauing a greater declination be it neuer ſo little, then is the altitude of the Equinoctiall anſwerable to your latitude: As foꝛ example, ſuppoſe your latitude to be 52. which if you take out of 90. then the remainder is 38. degrees, which is the altitude of the Equinoctial anſwereable to that Latitude, otherwiſe called the complement, then that ſtar neuer ſetteth in that Latitude. Againe if it be a South ſtarre hauing greater declination neuer ſo little then the complement of your Latitude, then that ſtar neuer riſeth aboue your Hoꝛizon. As foꝛ example, in the latitude, 52. the ſtarre called Hircus, that is the Goate, being the Noꝛth ſtarre neuer ſetteth in that latitude becauſe his Noꝛth declination is 45. degrees, which is greater then the complement of your Latitude by 7. deg. Alſo the ſtar called Lyra, whoſe declination is 38 degrees, like vnto the complement of your latitude doth neuer ſet, but only toucheth your Hoꝛizon aſwell at his riſing as ſetting, ſo contrariwiſe the ſtar called Canopus, being a South ſtar hauing 51. degrees 38. of South declination, neuer riſeth aboue your Hoꝛizon in the foꝛeſaide latitude 52. And by this rule you may iudge in like maner of all the reſt of the fixed ſtarres both Noꝛth and South.

How to know at what houre of the day or night any ſtarre riſeth or ſetteth.

Propoſition. 24.

FIrſt marke by the outwarde oꝛ inwarde ſhootinge of the longeſt tippe of the Starre, whether it be Noꝛth oꝛ South: foꝛ if it be Noꝛth, then counte amongſt the Meridians in the Mater ſo many Meridians as your

Latitude amounteth to, beginning at the Arletree, and so proceeding towardes the Northeast, which is betwixt the Northpole and the Equinoctiall on your left hand, but if the ſtar be South, then count your Latitude proceeding from the ſaid Arletree towardes the Southeaſt, which is betwixt the ringle & the Northpole on the right hande, and bring the tippe of the ſtarre to that Meridian which now ſignifieth your Horizon, and there ſtaying the Rete, bring the labell to the place or degree of the Sunne in the Zodiaque of the Rete, in which the Sunne is that day you ſeeke, and the houre in the limbe whereto the labell pointeth, is the houre at which the ſtarre ryſeth that day or night. Nowe to know when the ſame ſtarre ſetteth, you haue no more to doe but to worke with the ſtarre in the Northweſt parte in ſuch order as you obſerued before in the Northeaſt parte of the Aſtrolabe. As for example, I would know at what houre the Buls-eye called Oculus Tauri, doth riſe the laſt day of June, the Sunne being then in the 17. degree and 40. minutes of Cancer. Here becauſe this ſtarre is a North ſtarre, I bring the longeſt tippe thereof to the 52. Meridian which is our Latitude counting from the Arletree towardes the Northeaſt part of the Aſtrolabe which is on my left hand, for that Meridian is alwayes the Horizon ſeruing the Latitude 52. and there ſtaying the Rete I bring the Fiduciall line of the labell to the place of the Sunne which at that day is the 17. degree 40. of Cancer as I ſaide before, and I find that the labell pointeth to one of the clocke 30. after midnight wherefore I conclude that Oculus Tauri riſeth that day at that preſent houre. Now to knowe at what houre that Starre goeth downe, the ſame day I bring his longeſt tippe to the ſaide Horizon towards the Northweſt, and ſtaying the Rete there, I lay the labell to the 17. degree 40. of Cancer as before, ſo that the labell pointeth to foure houres and 20. minutes in the afternoone, at which time he goeth downe, ſo as hee continueth at that time aboue the Horizon in the Latitude 52. 14. houres 48. minutes. And to know the abode of any ſtarre aboue the Horizon, the nexte Propoſition doth alſo ſhew.

How

How to know how long any Starre continueth aboue the Horizon in euery Latitude.

Propoſition. 25.

BRing the Finitor to your Latitude, and loke in what point the Parallel or declination of the ſtar cutteth the Finitor, and the number of the meridians in the Mater contained betwixt the limbe and that point doe ſhew the halfe time of his abode aboue the Horizon, which being doubled is the whole time of his abode aboue ỹ Horizon. And in numbring the ſaid Meridians whereof 15. doe make an houre, remember to begin to count from the right ſide of the Mater, proceeding towards your left hand, and remember alſo that the middle Meridian or Axletree, ſignifieth alwaies the ſixth houre, ſo ſhall you not erre in your account As for example, hauing brought the Finitor to the Latitude 52. loke in what point the Parallel of the foreſaid ſtarre Oculus Tauri cutteth the Finitor, and by numbring the Meridians proceeding from the limbe on your right hand towards the left, you ſhall find the Parallel of Oculus Tauri, being 15. degrées 49. to cut the 111. Meridian, which being doubled, and then the ſumme thereof deuided by 15. maketh 14. houres and 48. as before.

How to finde out the Starres houre, and thereby to know the houre of the night.

Propoſition. 26.

FIrſt hauing taken the Starres Altitude, ſet the Finitor to your Latitude, and loke at what houre-tine in the Mater that Starres Almicanterath and ſhe Parallel of his declination doe méete, & hauing lought out the ſame houre in the limbe right a-

gainſt that point, bring the labell thereunto, for that is the ſtarres houre, and there ſtaying with your fingers end the very point of the labell, bring the longeſt tippe of the ſtarre to the Fiduciall line of the labell, and ſtaying there the Rete, turne the labell to the degree of the Zodiaque of the ſaid Rete, wherein the Sunne is that day, and the labell will point to the true houre of the night ſet downe in the outward limbe of the Mater. As for example, I ſuppoſe that the ſeuenth of October 1591. the Sunne being then in the 23. degree 15. of Libra, I tooke the altitude of the ſtarre Hircus, that is the Goate, which I found to be 20. degrees, here hauing ſet the Finitor to my Latitude 52. I looke in the Mater at what houre line that Almicanterath, and the Parallell of the ſame ſtarre which is 45. degrees Northward doe meete or croſſe one an other, and I finde that they meete iuſt vppon the fourth houre line of the forenoone, whereſore I ſeeke right againſt that point the ſame houre in the outermoſt limbe of the Mater, for that is the ſtarres houre, and hauing placed the labell at that houre, I ſtay it there with my finger vntill I haue brought the longeſt tippe of the Starre Hircus vnto the Fiduciall line of the labell, and there ſtaying the Rete, I turne the labell to the degree of the Sunne which is 23. degrees 15. minutes of Libra, and I ſee that the labell pointeth to the ſeuenth houre of the night ſet downe in the limbe of the Mater and halfe an houre paſt. Maiſter Blagraue ſaith that the ſooner you take the altitude of the ſtarre whereby you ſeeke to know the houre of the night, you ſhall haue the houre more truely.

How to finde out the diſtance betwixt any two ſtarres contained in the Net.

Propoſition. 27.

FIrſt conſider whether the declination of both ſtars be either South or North, or that the one be South and the other North, for if both their declinations be South or North, then you muſt not leaue to turne the Rete to and fro vntill you haue brought

brought the longest tippes of both starres to one selfe Meridian in the Mater, that done, count vpon the said Meridian how many degrees are contained betwixt the tippes of the saide starres, for that is the distance betwixt them. But if the one starre haue North declination and the other South, then turne the Rete to and fro vntill both starres doe lie vpon two such seuerall Meridians as each of them is equally distant on each hand from the Arietree, then count how many degrees or Meridians are contayned betwixt the Arietree and either of those stars (which you will) and that is their distance, so shall you find the distance betwixt Oculus Tauri, & Canis minor being both North stars to be 46. degrees 20. and the distance betwixt Oculus Tauri and Canis maior, whereof the first is a North starre, and the other a South starre to bee iust 46. degrees.

Another way to know the distance of any two stars, their Longitudes and Latitudes being first known, and also by that meanes to finde out the distance betwixt any two places vpon the earth.

Proposition. 28.

FIrst seeke to knowe the difference of their Longitudes by subtracting the lesser longitude out of the greater, then count that difference from the outermost Meridian of the Mater towardes the Centre, and marke well that Meridian at which your account endeth, then number vppon the limbe of the Mater from the Equinoctiall the greater Latitude eyther Northwarde or Southwarde according as the Latitude is, and to that pointe bring the Zenith of the Rete, then vppon the selfe same Meridian before marked count from the Equinoctiall the lesser Latitude, and looke what Azimuth passeth through that point, for the degrees which are contained betwixt that point and the Zenith shall bee the distance: and thus doing you shall finde the distance

betwixt Oculus Tauri and Canis maior to be 46. degrees and 15. and the distance betwixt London and Venice to be 12. degrees and 20. which 12. degrees being multiplyed by 60. maketh 720. miles, whereto if you adde for the 20. 20. miles, it will make in all 740. miles.

How to find out the degree of *Medium cæli* at any houre of the day (that is to say) the degree of the Zodiaque that is in the Meridian at any houre that you seeke, and also the degree called *Imum cæli*.

Proposition. 29.

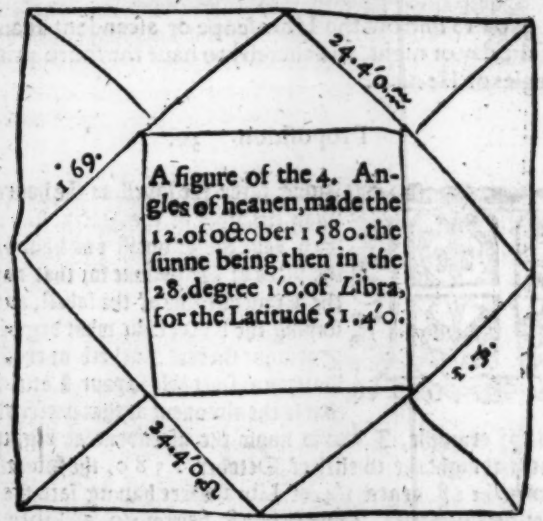
FIrst take out the place of the Sunne for that day in the Zodiaque of the Rete, and hauing laid the labell to the houre supposed vpon the limbe of the Water, bring the place of the Sunne to the Fiduciall line of the labell, and there staying the Rete, looke what degree of the said Zodiaque cutteth the none line or Meridian at nonetide, which you shall easily finde by laying the labell to the houre of 12. at none, for the Fiduciall line of the labell crossing the Zodiaque, will shew the degree of mid heauen at that houre. As for example, the 26. of June 1592. I would know the degree of Medium cæli, at eight of the clocke in the morning, the Sunne being that day in the 14. of Cancer. Here by laying the labell to the said houre in the limbe of the Water, I bring the place of the Sun to the Fiduciall line of the labell, and there hauing staid the Rete, I bring the Labell to the twelfth houre at none, and I find that the labell cutteth the Zodiaque of the Rete in the 18. of Taurus, which at that houre is the degree of Medium cœli, whose point opposite is the 18. degree of Scorpio, and that is at that houre Imum cœli which the labell being laid to the twelfth houre of midnight will shew.

How

How to find out the Horoſcope or aſcendent at any time of the day or night, and thereby to haue the foure principall Angles of Heauen.

Propoſition. 30.

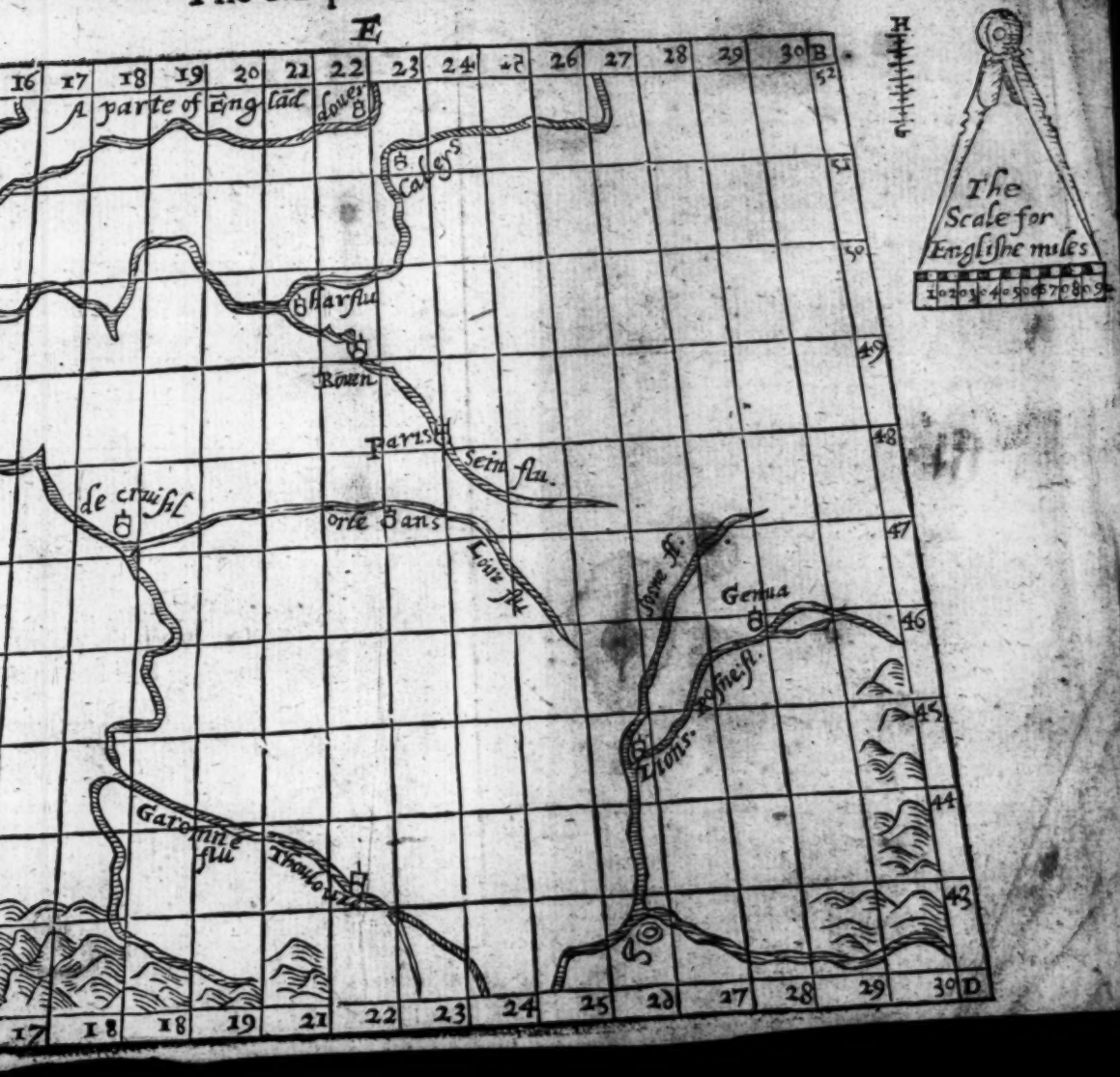
HAuing laide the labell to the houre giuen vpon the limbe of the Mater, ſtay it there with your finger vntill you haue brought the place of the Sunne for that day vnto the Fiduciall line of the labell, and there ſtaying the Rete, looke what degree of the Zodiaque thereof toucheth or croſſeth the Horizon anſwerable to your Latitude, for that is the aſcendent at that preſent houre. As for example, I would know the aſcendent at eight of the clocke at night the twelfth of October 1580. the Sunne being then in the 28. degree 14. of Libra. Here hauing laid the labell vpon the ſaid houre, I bring the 28. degree 0. of Libra to the Fiduciall line of the labell, and there ſtaying the Rete, I finde by helpe of the labell that my Horizon which is the 51. Meridian, and 40. counting on both hands from the Arietes, that the firſt degree of Cancer, doth croſſe my Horizon in the Northeaſt quarter, wherefore I affirme that to be the aſcention or firſt houſe, whoſe point oppoſite being the firſt of Capricorne, is the deſcendent or ſeuenth houſe, then by bringing the Fiduciall line of the labell to the South end of the Equinoctiall at which the ringle hangeth, I finde by helpe of the labell that the 24. degree 40. of Aquarius cutteth the Equinoctiall, which is the tenth houſe or Culmen cœli, whoſe point oppoſite being the 24. degree 40. of Leo, is the fourth houſe otherwiſe called Imum cœli, and thus you haue all the foure principall houſes of heauen for that houre, as you may ſee in this figure here following.



But the difficultie of finding out the true ascendent consisteth in knowing whether it is to be sought in the Northeast quarter, or in the Southeast quarter of the Iewell. The Northeast quarter is that which lyeth betwixt Imum cœli, and the North Pole or East end of the Arletes, because in this case the Arletes signifieth the line of East and West, and the Equinoctiall signifieth the line of South and North, at the South ende whereof is fastned the ringle or handle. But in the former example you may plainely see that the North part of the Zodiaque of the Rete doth cut the Horizon, as well in the Northeast quarter as in the Southeast quarter with two seuerall degrees & signes, for in the Northeast quarter the Zodiaque cutteth the Horizon with the first of Cancer which is the ascendent, and in the Southeast quarter it cutteth the Horizon with the eight of Taurus, which is not the ascendent: for you haue to vnderstand that euery degree of the Zodiaque doth both rise and set either towards the North or towards the south, the first point of Aries and of Libra onely excepted, both which do rise right East, and goe downe right West, euen as the Equinoctiall



The Map of Fraunce.



BRITISH
15 JY 1915
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noctiall doth, whereof M. Blagraue doth gather a rule how to find out by his Iewell when the aſcendent is to be ſought either in the northeaſt quarter of the Mater, or in the ſoutheaſt quarter, which is thus: The aſcention of any of the ſixe Northerne ſignes is to be ſought for, in the Northeaſt part of the Iewell, and the aſcention of any of the ſixe Southern ſignes is to be ſought for in the ſoutheaſt part of the Iewell. For although that the North part of the Zodiaque of the Rete containing the 6. Northern ſignes cutteth the Horizon anſwerable to your Latitude, aſwell in the Northeaſt as in the Southeaſt part of the Iewell, yet you muſt ſeeke the aſcendent in the Northeaſt part, and not in the Southeaſt part of the Iewell, becauſe that euery degree of any of the ſixe Northerne ſignes riſeth Northernly: ſo contrariwiſe if the South part of the Zodiaque containing the ſixe Southerne ſignes doe cut the Horizon, aſwell in the Northeaſt part as in the Southeaſt part of the Iewell, yet you muſt ſeeke the aſcendent in the Southeaſt part, and not in the Northeaſt part of the Iewell. As for example, the ſecond day of Auguſt 1592. the ſun being in the 20. of Leo, I would know the aſcendent at foure of the clocke in the afternoone: here hauing laid the label to that houre, & brought the place of the Sun to the Fiduciall line thereof, I find that the 13. degree 30. of Aquarius doth cut the Horizon ſeruing to your latitude 52. in the Northeaſt part of the Iewell, and that the 19. of Sagittarius cutteth the ſaid Horizon in the Southeaſt part of the Iewell, which muſt be the aſcendent, becauſe that euery degree of any of the Southerne ſignes riſeth Southernly, and not Northernly.

How to find the Circles of poſition, and to know how much the Pole is eleuated aboue euery ſuch Circle in any Latitude, without the knowledge whereof you cannot find out the twelue houſes by this Aſtrolabe.

Propoſition. 31.

FIrſt bring the Zenith of the Rete to your Latitude, ſo ſhal the Azimuthes become circles of poſition, then vpon the Parallel of declination of the point giuen, according as the declination thereof is north or ſouth count from the limbe on your right hand, the number of the hours giuen

giuen amongst the Meridians in the Mater, & the Azimuth which the Meridian of that houre cutteth shall be the Circle of position, which had, you shall find the eleuation of the pole aboue the Circle of positiõ thus: Count your latitude amongst the Almicanteraths from the Zenith vpon the Circle of position found, and to that point whereas your Latitude endeth, bring the Fiduciall line of the label, & reckon vpon the label how many degrées are contained betwixt the limbe of the Rete & that point, for the number of those degrées is the eleuation of the Pole aboue the Circle of position. As for example vsed by M. Blagraue himselfe, the 12. of October 1580. the Sun being then in the 29. degré 1'0. of Libra, and his South declination 11. deg. 1'0. I would know at 8. of the clocke at night in what Circle of position the Sun at that time was, here I bring the Zenith to the Latitude of Reading, which is 51. deg. 4'0. then for 8. of the clocke I count 8. houres amongst the Meridians in the Mater, from the South part of the Iewell vpon the Parallell of the sunne being then 11. deg. 3'0. and by attributing to euery houre 15. Meridians, I find that the Meridian whereas the 8. houre endeth doth crosse the 28. & ½. Azimuth, counting the Azimuths from the Zenith line, and that is the Circle of position wherein the Sun was then vnder the earth in the Northeast quarter. Now to know how much the Pole is eleuated aboue that Circle of position, I doe count from the Zenith the foresaid Latitude 51. degrees, 4'0. vpon the said Circle of position, and to the point where that Latitude endeth I bring the label, and counting thereon from the limbe of the Rete the degrées contained betwixt the said limbe, and the foresaid point. I finde the number of them to be 43. degrées 3'0. wherefore I conclude that the Pole is eleuated aboue the said Circle of position 43. degrées 3'0.

How to find out all the 12. houses of heauen, and thereby to erect a figure at any houre of the day or night.

Proposition. 32.

YOu shall vnderstand the order of this better by this one example giuen by M. Blagraue himselfe then by manifold rules which be also so plainely expressed and obserued in this example, as you néde none other instruction

ſtruction to erect the like figure in any Latitude, and at any houre of the day or night. Suppoſe then that you would erect a figure for one that was borne the twelfth of October 1580. at eight of the clocke at night in the Latitude 51.40. the ſunne being then in the 28. degree 10. of Libra, and his declination being at that time 11. degrees 10. Southwarde: Here firſt ſet downe in your figure already drawne the foure Angles before found by the 30. Propoſition anſwerable to the ſaide day and houre, then to finde out the reſt of the houſes doe thus, bring the Zenith of the Rete to the latitude preſuppoſed, which is 51. degrees 40. and ſtaying it there, marke what number of Azimuthes or Circles of poſition doth cut euery 30. degree of the Equinoctiall, counting the degrees of the Equinoctiall by helpe of the Meridians from the limbe towardes the Centre, but you muſt count the number of the Azimuthes or Circles of poſition from the Zenith line towards the limbe, of which Circles of poſition there be no more but five at the moſt (that is to ſay) three betwixt the limbe and the Centre on the one ſide, and as many on the other ſide of the Centre, the eleuation or rather depreſſion of euery one whereof you muſt ſeeke to know by the laſt Propoſition. But M. Blagraue ſaith that you neede to know the eleuation or rather depreſſion but onely of two Circles of poſition, that is of that which ſheweth the eleuenth and third houſe, and of that which ſheweth the twelfth & ſeconde houſe, and ſo ſaith Stadius alſo in the beginning of his Ephemerides, treating of the 12. houſes, for hauing them you haue all the reſt. The order of working according to M. Blagraue his rule is thus: hauing brought the Zenith to the foreſaide Latitude, looke what Circle of poſition cutteth the Equinoctiall in the firſt 30. degrees next to the limbe, and you ſhall finde that the 47. Azimuth or Circle of poſition (counting from the Zenith line) cutteth that point of the Equinoctial, and therewith ſerueth to the eleuenth houſe and alſo to the third houſe, and the eleuation of this Circle is 32. degrees, then from thence tell vpon the Equinoctiall 30. degrees more, which doe make in all 60. degrees, and through that point you ſhall finde the 19. Azimuth or Circle of poſition to paſſe whoſe eleuation is 47. degrees and this Circle ſerueth to the 12. houſe and to the ſecond houſe. Now keeping well in mind thoſe two laſt

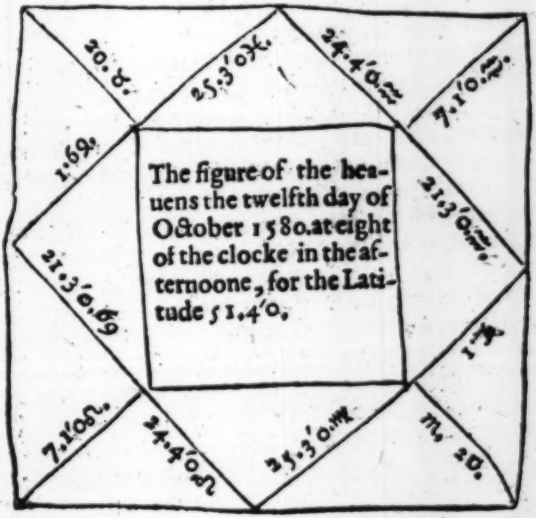
eleuations

eleuations, that is, 47. and 32. worke thus: Lay your labell to the eight houre of the morning, which is 30. degrees diſtant from the right Horizon or Arietree, and bring to the Fiduciall line thereof the Culmen cœli or 10. houſe firſt ſet downe in your figure which is the 24. of Aquarius, and ſtaying it there, looke what degree of the Ecliptique cutteth the 32. Horizon which ſerueth to the 11. houſe counting from the right Horizon towardes your left hande. And by following that Horizon vp towardes the North pole, you ſhall finde that the 25. degree 30. of Piſces cutteth the ſame Horizon verie nigh vnto the Pole, but by my inſtrument I find it to be the 27. degree of Piſces, which perhaps is not truly made, and therefore ſet downe in the eleuenth houſe of your figure 25. degrees 30. of Piſces. Then bring the foreſaid Culmen cœli together with the labell to the tenth houre of the morning, which is 30. degrees further towards the South, and ſtaying it there, looke what degree of the Ecliptique cutteth the 47. Horizon, ſeruing to the twelfth houſe, and you ſhall find that the 20. degree of Taurus cutteth that Horizon, wherefore ſet downe the 20. of Taurus in the twelfth houſe of your figure, then bring the Culmen cœli together with the labell to the 12. houre at noone, and you ſhall ſee the aſcendent which is the firſt of Cancer to cut the oblique Horizon which is 51. degrees 40. and from thence bring the label and culmen cœli to two of the cloke in the afternoone, and ſtaying it there you ſhal ſée the 21. degrée of Cancer to cut the 47. Horizon which ſheweth the ſecond houſe and alſo the twelfth houſe as before, wherefore ſet downe 21. of Cancer in the ſecond houſe of your figure, that done, remoue the labell together with Culmen cœli to foure of the cloke in the afternoone, and there ſtaying it, you ſhall ſee the ſeuenth of Leo to cut the 32. Horizon which ſheweth both the third houſe and the eleuenth houſe as before wherefore ſet the ſeuenth of Leo in the third houſe of your figure, ſo haue you eight of the houſes, that is to ſay, the firſt, the ſecond, the third, the fourth, the ſeuenth, the tenth called Culmen cœli, the eleuenth and the twelfth, ſo as there want onely foure, that is, the fifth, the ſixth, the eight and the ninth houſe. The fifth is oppoſite to the eleuenth, the ſixth to the twelfth, the eight to the ſecond, and the ninth to the third, whoſe oppoſite ſignes ech one hauing like num-

ber

ber of degrees are to be placed in the foure houses of your figure that be wanting. As in the fifth house the 25. degree 30. of Virgo, in the sixth house the 20. degree of Scorpio in the eight house the 21. degree 30. of Capricorne, and in the ninth house the 7. degree 10. of Aquarius, so haue you all the twelue houses. And by this meanes M. Blagraue saith that you may make the places of the twelue houses to serue for euer in any Latitude, so as you doe distinguish from the rest with some colour those two Horizons whereof the one doth shew the eleuenth and the third house, and the other Horizon sheweth the twelth and second house. yea and by this meanes you may (as he saith) make as true Tables to finde out the twelue houses in euery Latitude as those that be calculated of purpose.

The figure of the foresaid twelue houses.





A nevv and neceſſarie Treatiſe of Nauigation con-

taining all the chiefeſt principles of that Arte.

Lately collected out of the beſt Mo-

derne writers thereof by M. Blundeuile, and by him reduced into ſuch a plaine and orderly forme of teaching as euerie man of a meane capacitie may eaſily vnderſtand the ſame.



They that goe downe to the Sea in ſhips, and occupie their buſineſſe in great waters: Theſe men ſee the workes of the Lord and his wonders in the deepe. Pſalme. 107



Of Nauigation, what it is, and with what order the principles thereof are here taught by Maiſter Blundeuill, according to the rules of the beſt moderne writers of that Arte.

NAVIGATION is an Arte which teacheth by true and infallible rules, how to gouerne and direct a ſhippe from one port to another ſafely, rightly, and in ſhorteſt time: I ſay here ſafely, ſo farre as it lyeth in mans power to performe. And in ſaying rightly, I meane not by a right line, but by the ſhorteſt and moſt commodious waye that may be found: And by ſaying in ſhorteſt time, I meane thereby according as the ſhip is good of ſayle, and according as both winde and tide ſhall ſerue.

The meanes to attaine to this Arte as to all other Artes are two parts, whereof euery Arte conſiſteth, that is Methode and Practiſe, which is as much to ſay here as inſtruction and experience: For of the chiefe points of this Arte, ſome are to be learned by inſtruction, and ſome onely by experience: for what inſtruction I pray you will ſerue to make a good coaſter, that is to ſay, to know any Cape or Cliffe when he ſeeth it, vnleſſe he hath firſt ſeene it & hath before taken good markes thereof. Alſo to know the currents in all places, the deapth and qualities of waters, ſands, flats, or ſhoulds, and ſuch like, the perfect knowledge whereof conſiſteth chiefely in experience. Of which experience I minde not heere to treate, becauſe I knowe that a Dutchman called Wagoner or Aurigarius hath lately written of theſe things notably wel & eſpecially for theſe our ſeas and the Northeaſt ſeas, whoſe booke I doubt not but that ſome of our learned ſea men will ſet foorth in

our mother tongue, with some augmentation of their owne experience for the East and West Indies, for the profite of their countrie and to their owne praise & commendation. In the meane time I will proceede with instruction, the chiefe pointes whereof are these here following: first to know the vses of such instrumentes as euery skilfull sea man ought to haue with him that mindeth to sayle any long voyage, which are these here following: First a perfect Kalender or Ephemerides, the Mariners ring or Astrolabe, the Crosse-staffe called of the Spaniards Balla stella, the two Globes both Celestiall and Terrestriall: Of all which things I haue in a manner already written seuerall Treatises. Item an vniuersall Horologe, to know thereby the houre of the daye in euery Latitude and a Nocturnlabe to knowe thereby the houre of the night. And it were necessarie for him that saileth long voiages to carry with him a Topographicall instrument to describe thereby those straunge Coasts & Countries whereby he sayleth, the vse of which instrument is plainely taught by William Borne in his booke called the Treasure of Trauailers, and by Master Digges in his book called the Pantometria, wherefore I shall not neede to speake any further thereof: Also the Mariners compasse whereof I do not only make a plaine description and shewe the vses thereof, but also how to finde out the variation of the same, according to the precepts of the best moderne writes thereof. And lastly the Mariners Carde, whereof whilest I speake, I doe not onely shewe the making thereof, and how to drawe the Parallells in better sort then they are vsed to be drawne in the common Cardes, but I set downe therwith the chiefest vses of the Carde, amongst which is taught how to knowe by help of the Carde and certaine Tables made of purpose, what way your ship hath made in sayling by any rombe or wind, yea in sayling right East & West, which heretofore (as Cognier saith) hath beene thought a thing impossible to be knowne, but onely by coniecture: And being out of your way how to know in what place you are & to marke the same in your Carde that you may the more readely direct your ship againe to the place whereunto you would goe. But all these instrumentes serue to little purpose, vales you know alss the north star with his guards, & diuers other stars situated aswel towards the

North

North as towardes the South Pole, together with their Longitudes, Latitudes, declinations and greatnesse, to know thereby the Latitude of any place, & the houre of the night: also the course of the sunne and his declination, by helpe whereof you may know the Latitude of any place, the times and seasons of the yeare, the houre of the day, and the length of the day and night in euery latitude. And finally you must know the course of the Moone, whereon dependeth the knowledge of the tydes in all places: Of all which things I mind here to treat in such order as the Chapters hereafter following doe shew.

A generall Kalender or Almanacke for euer, containing these 9. Chapters next following.

HOw to find out the golden number euery yeare. Chap. 1.
How to find out the Epact in euery yeare. Chap. 2.
How to know the Epact by the Mariners rule vpon your thombe. Chap. 3.
How to knowe the age of the Moone in euery moneth throughout the yeare. Chap. 4.
How to know the change, full, & 4. quarters of the Moone, euery moneth throughout the yeare. Chap. 5.
How to know in what signe and degree the Moone is euery day throughout the yeare. Chap. 6.
How to finde out the moueable feasts euery yeare, onely by knowing the day of coniunction in the moneth of February. Chap. 7.
How to finde out the circle of the Sunne, called in Latine *Cyclus Solaris*, and thereby the Dominicall Letter in euery yeare. Chap. 8.
How to find out the number of indiction. Chap. 9.

A briefe description together with the vse of the Diurnall

Table or Almanacke of *Iohannes Stadius*. Chap. 10.

How to find out the place of any Planet by the Ephemerides. Chap. 11.

Of the Mariners Ring or Aſtrolabe, and of his croſſe ſtaffe, Chap. 12.

A briefe deſcription of M. *Hood* his croſſe ſtaffe, and of all the parts thereof. Chap. 13.

How to ſet the partes of M. *Hoods* ſtaffe together to ſerue ſuch Aſtronomicall vſes as do chiefly belong to the Mariner. Chap. 14.

The ſhape or figure of the foreſaid ſtaffe, hauing all his parts ſet together to ſerue for Aſtronomicall vſes. Chap. 15.

How to take the altitude of the Sunne at any houre that he is to be ſeene with the eye by M. *Hoods* ſtaffe. Chap. 16.

How to take the altitude of any Starre with M. *Hoods* ſtaffe. Chap. 17.

How to take the diſtance betwixt two ſtars with M. *Hoods* ſtaffe. Chap. 18.

Of the Mariners Aſtrolabe. Chap. 19.

A briefe deſcription of the Mariners Aſtrolabe, and the vſe thereof. Chap. 20.

A briefe deſcription of the Mariners croſſe ſtaffe. Chap. 21.

The vſes of the Mariners croſſe ſtaffe. Chap. 22.

Of the wind, what it is, and of the diuers kindes and names thereof. Chap. 23.

A briefe deſcription of the Mariners Compaſſe, and vſe thereof. Chap. 24.

Of the Lodeſtone, and of the variation of the Compaſſe in Northeaſting and Northweſting. Chap. 25.

How to find out the variation of the Compaſſe in euery latitude. Chap. 26.

Of the Mariners Card, and the making thereof. Chap. 27.

The ſhape & figure of the firſt lineaments of the Mariners Carde drawne after the olde manner, and how to ſet downe the places of the land or ſea therein. Chap. 28.

A Table to draw th erby the Parallels in the Mariners card, together with the vſe thereof in truer ſort then they haue beene

beene drawne heretofore. Chap. 27.

The draught of the Meridians and Parallels of the *Mariners* Carde or nautical Planiſpheare according to the former table, Chap. 30.

The foure chiefeſt vſes of the Mariners Card. Chap. 31.

How to know the way of your ſhip, and how many leagues are to be accounted for one degree of Latitude in euere rombe wherby you ſaile. Chap. 32.

How to account the leagues in ſayling directly Eaſt or weſt without changing latitude or altitude of the Pole. Chap. 33.

A Table to helpe you to know what way your ſhippe hath made in ſayling right *Eaſt* or Weſt without changing your latitude, together with a briefe deſcription and vſe thereof. Chap. 34.

An example of counting the way of your ſhippe in ſayling right *Weſt*. Chap. 35.

An other example of counting the way of your ſhip in ſayling right Eaſt. Chap. 36.

To know how much you goe out of your way in ſayling by one wrong rombe or by more, chap. 37.

Of the North Starre, otherwiſe called the Loadeſtarre, and of his guardes, and how to know the ſame. Chap. 38.

The vſes of the North ſtarre and of his guardes. Chap. 39.

To know by helpe of a little table made according to the Mariners rule touching the 8. principall rombs ſhewing how much and when the Loadeſtar is either aboue or beneath the Pole, that you may know thereby the true altitude of the Pole in taking the height of the Loadeſtarre with your Aſtrolabe or croſſeſtaffe. Chap. 40.

How to make an Inſtrument which will ſhew at any houre of the night how much the Loadeſtarre is either aboue or beneath the Pole in euery other rombe as well as in the 8. principall rombes, and alſo the true houre of the night. Chap. 41.

How to know by the foreſaid twofold inſtrumēt as wel the mounting and deſcending of the North ſtar as the true houre of the night both at one inſtant and alſo the eleuation of the Pole. Chap. 42.

What ſtars are to be obſerued by thoſe that ſayle beyonde the Equinoctiall vnder the South Pole. Chap. 43.

Of the Sunne, and of his motion, and of the chiefeſt apparances belonging to him. Chap. 44.

A Table ſhewing the declination of the Sunne euery day throughout the yeare, and the vſe thereof. Chap. 45.

Of the foure ſeaſons of the yeare, that is Spring time, Summer, fall of the leafe, called otherwiſe Autumne, and Winter. Chap. 46.

How to knowe when the Sunne riſeth and ſetteth in euerie latitude. and thereby the length of the day and night, and alſo in what rombe or wind he riſeth and ſetteth, and how much he declineth euery day from the Equinoctiall either Northward or Southwarde. Alſo how to know the eleuation of the Pole, otherwiſe called the latitude of any place, by knowing the Meridian Altitude of the Sun, & his declination. Chap. 47.

Of the ſhaddow of the Sun, and how to know thereby the houre of the day in any latitude by helpe of an vniuerſall diall. Chap. 48.

Of the Moone and of all her diuers motions. Chap. 49.

How to know what ſigne the point Auge of the Moone is in any yeare. Chap. 50.

When the Moone is ſaid to be in Coniunction with the Sun or to be at the full, and what her greateſt latitude is, aſwel frō the Ecliptique line, as from the Equinoctial. Chap. 51.

How to know In what part of the Zodiaque the head of the Dragon is euery yeare. Chap. 52.

How to know the tides in any place by the Moone. Chap. 53.

How to know by helpe of an inſtrument the tides at any place. Chap. 54.

How a general Rutter ſhewing the tides in al Places ſhould be made. Chap. 55.

A generall Kalender or Almanacke for euer.

WHat this word Kalends signifieth, and from whence it is deriued is before set downe in the first booke of my Treatise of the Spheare the 45. chapter. But because there bee generall rules to knowe the coniunction of the Moone with the Sunne, her full, and all her foure quarters, and also the moueable feastes and Dominicall letter, and such like thinges easily to bee learned without the helpe of any particular Kalender, I thought good first to set downe this generall Kalender, containing 9. propositions, as followeth.

How to finde out the Golden number euery yeare, Chap. 1.

THe Golden number is the number of 19. proceeding from 1. to 19. and so to begin againe at 1. And it is so called because it was sent in golden letters frō Alexandria in Ægypt to Rome: for in 19. yeares the Moon doth make all her sundry motions & changes, and returneth againe to the place where she first began. And to finde the foresaide number the way is thus. Adde 1. to the yeare of the Lord whereof you inquire, and diuide the same by 19. and the remainder shall be the Golden number for that yeare: As for example, being desirous this present yeare 1590. to knowe the Golden number, I adde 1. to the said yeare, and so make it 1591. which being diuided by 19. there remaineth 14. which is the Golden number of this present yeare.

But when there is no remainder, then 19. is the Golden number, and remember that the Golden number beginneth alwayes at the first of January, and the Epact the first of March.

How

How to find out the Epact in euery yeare.

Chap. 2.

THe Epact is a number not exceeding 30. because the Moone betwixt change and change, neuer passeth 30. dayes, and thereby the common Lunar yeares consisting of twelue Moones is lesser then the Solar yeare by 11. dayes, for to euery mooneare attributed no more but 29. dayes and a halfe, which make in all 354. dayes, so as the common Solar yeare consisting of 365. dayes exceedeth the Lunar yeare 11. dayes from whence the Epact taketh his originall, which Epact is found thus. Multiply the golden number of the yeare by 11. the product whereof if it be vnder 30. then it is the Epact But if the product be aboue 30. then diuide the product by 30. & the remainder shalbe the Epact. As for example: to know the Epact in the yeare 1590. the golden number being 14. as before: here hauing multiplyed the same by 11. and diuided the product thereof by 30. I find the remainder to be 4. which is the Epact of the said yeare. Also by knowing one former Epact you shall haue it euer after by adding thereunto 11. and if the number doe excéde 30. then you must diuide the same by 30. and the remainder shall be the Epact as by adding 11. to 4. I knowe the Epact shall be the next yeare which is 1591. the number of 15. and by adding 11. to 15. the Epact in the yeare of our Lord 1592. shalbe 26. and so forth

How to know the Epact by the Mariners rule vpon your thumbe

Chap. 3

FIrst, you must suppose the inside of your left thumbe to be diuided into thrée spaces, and the nethermost space to contane 10. the middle space 20. and the highest space to warde your thumbes end, to containe 30. and knowing first the golden number, begin to tel the same at the nether space saying there 1. at the middle space 2. at the third space 3. then be-

beginne againe at the lowest space, and there say 4. and so continue your account still after that manner vntill you haue the full summe of the Golden number, and marke vpon what space the full summe falleth, for the Golden number being added to the number of that space, doth shew the Epact, so as the totall summe doth not exceed 30. for then you must subtract 30. and the remainder shall be the Epact: as for example, in the yeare 1591. the Golden number is 15. which being counted vpon your thombe in such order as is before taught, it will fall vpon the highest space, which is 30. to which if you adde the Golden number which is 15. it will make in all 45. from which summe if you subtract 30. there will remaine 15. which shall be the Epact for that yeare, so as the Epact and Golden number in that yeare are like numbers. For euery three yeares they are alwaies like, as when the Golden number is either 3. 6. 9. 12. 15. or 18. the Epact hath also like number.

How to knowe the age of the Moone in euery moneth throughout the yeare.

Chap. 4.

ADde to the Epact the number of moneths from the beginning of March, together with the moneth wherein you seeke, and also the number of the daies past of that moneth, wherein you seeke, and the summe of such addition will shew you the age of the Moone, as for example, I would know the age of the Moone the first day of December in the yeare 1590. Here knowing the Epact of that yeare to be 4. I adde thereunto the nuwber of the moneths from the beginning of March, which are 10. monethes, and also the number of daies of December, which are fiue, and the summe thereof is the age of the Moone, if the summe be lesse than 30. But if the summe of such addition doe exceede 30. then you must subtract 30. and the remainder shall be the age of the Moone, so as the moneth wherein you seeke haue 31. daies, for if it hath lesse than 31. daies,

then

then you muſt ſubtract but 29. and the remainder ſhall be the age of the Moone, as for example, ſuppoſe you ſeeke the age of the Moone the 22. of Nouember in the yeare 1589. in which yeare the Epact was 23. here by adding to the Epact firſt 9. Monethes, and then twentie two daies, it maketh in all 54. out of which by ſubtracting 29. becauſe Nouember hath but 30. daies, the remainder is 25. which was the age of the Moone in that moneth, day, and yeare.

How to know the change, the full and foure quarters of the Moone euery moneth throughout the yeare.

Chapter. 5.

MArtin Cortes in his booke called the Arte of Nauigation teacheth a rule to finde the day of the change, in euery moneth by knowing the age of the Moone that day you ſeeke, and then by reckoning from that day backward the number of the daies that went next before, or elſe by taking the age of the Moone out of the daies of the moneth that went next before, as for example, the laſt of October 1592. I finde by the fourth propoſition the age of the Moone to be 5. which being taken out of 31. (for ſo many daies October hath) there remaineth 26. which day by this meanes ſhould be the day of the change, but the very day indeede was the 25. of the ſaid moneth, for the former rule to know the age of the Moone is not ſo true it ſelfe, but that ſometime it will fall a day either ouer or vnder. But Gemma Friſius teacheth to finde out the day of the change in euery moneth thus. Adde to the Epact the number of the moneths from the beginning of March whereof that moneth wherein you ſeeke the change, muſt be counted as one, and then ſubtract the product or ſum of that addition from 30. and the remainder will ſhewe the day of the change, which rule I finde to be true ſo long as the ſumme of the addition doth not exceede 30. but when the ſum of the addition is more than 30. which will commonly chaunce when the Epact is a great number, as 26. or 29. he teacheth no rule for that, wherefore I thinke it beſt to take ſuch ſumme out of 59. and the remainder

mainder shall bee the day of change, or at the most but one daye ouer or vnder, and hauing the day of the change, you shall haue the day of the ful by adding 15. dayes more to the day of change: And hauing the change and the full, you shall easily haue all her foure quarters by adding or subtracting 7. daies.

How to know in what signe and degree the Moone is euery day throug hout the yeare.

Chapter. 6

SOme doe set downe rules to knowe in what signe and degree the Moon is euery day but such as are not true. And to say the truth the Moon hath so many diuers motions as it cā not be done but by speciall Tables calculated of purpose. And by what rule soeuer you worke, you must first know the place of the Sunne, which the Ephemerides most truly sheweth & in looking for that, you shal also find hard by it the place of the Moone, that is to say, in what signe and degree shee is euerye day, and so orderly the place of any other Planet, and therefore I leaue to speake any further thereof.

How to find out the mooueable Feasts euery yeare, only by knowing the day of coniunction in the month of Februarie.

Chapter. 7.

THe way to finde out the Coniunction in euerye moneth is before taught in the fift Propositiō And hauing the day of the coniunction in Februarie, you may assure your selfe that the next tuesday following is alwaies Shrouetuesday, for though the Coniunction it selfe doe fall vppon a Tuesday, yet the next Tuesday after that, shall bee Shrouetuesday, and the next Sunday after that, is called Quadragesima, which is the first Sunday in Lent, and sixe weekes next after that

that is Easter day, wher vnto if you adde fiue weekes more, that is to say, 35 dayes, you shall haue Rogation Sunday, and foure dayes next after that is Ascention day, and tenne dayes next after Ascention day is Penticoste or Whitsunday and seauen dayes next after that is Trinitie Sunday, and foure dayes next after that is the Festiuall day called Corpus Christi. And you haue to note that the Sunday called Aduentus Domini, which we call the first Sunday in Aduent, is alwaies the fourth Sunday before Christmasse day, and the Sunday called Septuagesima is the third Sunday before Quadragesima, otherwise called the first Sunday in Lent and betwixt Septuagesima and Quadragesima there are other two Sundayes, whereof that which is next before Quadragesima, is called Quinquagesima, and the next Sunday before that is called Sexagesima.

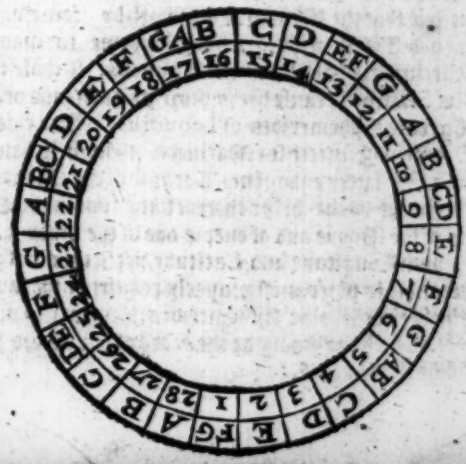
How to finde out the Circle of the Sunne called in Latine by a Greekish name *Cyclus Solaris*, and thereby the Dominicall Letter in euery yeare.

Chapter 8.

THis Circle was inuented more to finde thereby the Dominicall Letter than to shew any great changes of the Sunnes motions therein: And because there be seuen dayes in the weeke, commonly signified by seauen letters, A.B.C.D.E.F.G. This Circle therefore is made to containe twentie eight yeares, for foure times seuen doe make twentie eight, by helpe whereof is known the true order of the letters, whereof A. signifieth alwaies the first day of euerie yeare, and for euery leape yeare are appointed two Dominicall Letters, whereof the one continueth from the beginning of that yeare vntill Saint Mathias euen, and the other from thence to that yeares end, as you shall more plainely perceiue by that which followeth. And first I will shewe you howe to find out the iust number of the Circle of the Sunne euery yeare, which is done thus.

Adde

Adde to the yeare of the Lord giuen or ſuppoſed 9. and diuide that product by 28. and the remainder ſhall be the number of the foreſaide Circle: As for example, I would know the number of the ſaid Circle in the yeare 1590. whereunto by adding 9. I make the ſumme to be 1599. which being deuided by 28. there remayneth 3. Now to finde out the Dominicall letter, by the number of the ſaide Circle you muſt reſort to the figure following, conſiſting of three Circles, making two ſpaces, in the vpper ſpace whereof are ſet downe the foreſaide ſeuen letters, and in the neither ſpace the numbers of the Sunnes Circle, in ſuch ſorte as euery number hath his proper Dominicall letter ſtanding right ouer his head, and for euery leape yeare there are ſet downe two Dominicall Letters. All which letters are to bee counted backwarde, and not forwarde as they are placed in the Almanackes. As for example, hauing found the number of the Sunnes Circle for the yeare 1590. to bee 3. in the lower ſpace, you ſhall finde out the letter D. ſtanding ouer his heade, which is the Dominicall letter for that yeare. And note that when 28. is the number of the Sunnes Circle A. is alwayes the Dominicall Letter, from which number you muſt beginne to count againe at one and ſo proceede backeward to 28.



How to find out the number of Indiction.

Chapter 9.



This number consisteth of 15. yeares, and is commonly set downe in all the Charters of the Bishops of Rome, and in the instruments and writings of their Pronotaries, and therefore is called Indictio Romana, wherein they seeme to follow the ancient Romans, which vsed the like indiction of yeares but to other purposes, whereof I make mention in my Spheare: The way to finde out this number euerie yeare is thus, Adde to the yeare of the Lord giuen 3. and deuide the product thereof by 15. and the remainder shall be the number of the saide indiction. But you haue to vnderstand that this Indiction is to be counted from September, and not from March, as is the Epact.

But the surest, and therewith the most generall Kalender to serue in all places is the Ephemerides or daply Almanacke and especially that of Iohannes Stadius, which will serue for 14. yeares yet to come: And before those yeares bee all expired, I doubt not but that the like will be set forth by some one or other of our learned Astronomers, amongst whome for many yeares past the Germaines haue been most famous. I chose the Ephemerides of Stadius because hee is more portable, and of lesse price than that greate Ephemerides of Leouitius. The chiefest vses whereof, and most meete for Mariners, though I haue already set downe in the latter ende of my Treatise of the Globes, to the intent you might by the helpe thereof finde out in the Globe the true place of the Moone and of euerie one of the other 5. Planets that hath both Longitude and Latitude, yet I thinke it good once againe here in this place, most properly requiring the same, briefly to shew the vse of the saide Ephemerides, & especially of the diurnall Table, which beginning at the yeare of our Lord 1583. endeth with the yeare 1606.

A briefe

A brieſe deſcription together with the vſe of the diurnall Table or Almanacke of *Iohannes Stadius*.

Chapter 10.

THis Table beginneth at the 202. Page of his booke called the Ephemerides or daily Almanack And euery page of the ſaide Table that is on the left hande is diuided into 9. collums. In the firſt collum whereof on the left hand are ſet downe the daies of the moneth. Firſt, the Gregorian dayes according to the Romane account, & next to that the dayes of the month according to our Engliſh account, and then in the front of euery other collum are ſet downe the characters, firſt of the Sunne and then of the other fiue Planets, that is to ſay, of the Moone, Saturne, Iupiter, Mars, Venus, Mercurie, and laſt of all, the heade of the Dragon figured thus ☊. And right vnder the ſeuen Planets, and alſo vnder the heade of the Dragon are ſet downe the ſignes and degrees wherein euery of theſe is euery day of the moneth throughout the yeare at noonetide. And in the foote of the ſaid Table is ſet downe the Latitude of euerie one of the fiue Planets, proceeding by the daies of the month diuided into three parts. And in the margent of euery left page are ſet downe the chiefeſt feaſts and Saints dayes that fall in euery moneth throughout the yeare. And moreouer, in the Table on the right hande right againſt the left Table are ſet downe firſt the dayes of the month, and then what coniunction or any other aſpect the Moone hath with any of the other fiue Planets, that is, with the Sun, with Saturne, with Iupiter, with Mars, with Venus, and with Mercurie, which planets are ſet downe in the front of the ſaid Table, and vnder them the Characters of ſuch aſpects as the Moone hath that day with any of the other Planets. The characters of which aſpects are theſe here following.

☌ ☍ △ □ ⚹

Whereof the firſt ſignifieth a Coniunction, the ſecond an oppoſition, the third a trine aſpect, the fourth a quadrat aſpect, and the laſt a ſextile aſpect.

Two Planets are ſaid to be in a conſunction when they are both in one ſelfe ſigne.

And to be in an oppoſition when they are in two ſeuerall ſignes diſtant one from another, that is to ſay, 6. ſignes diſtant one from another.

And to be in a trine aſpect when they are diſtant one from another by foure ſignes.

And to be in a quadrat aſpect when they are diſtant one from another by three ſignes.

And to be in a ſextile aſpect when they are diſtant but 2. ſignes one from another.

How to finde out the place of any Planet by the Ephemerides.

Chapter 11.

HOw to finde out the place of any Planet, or of the head of the Dragon by this diurnall table, you muſt firſt ſeeke out the day of the moneth in the firſt Collum of the left Table, and right againſt that on your right hand in the ſaid left Table, you ſhall find in the common Angle right vnder the Planet or Dragons head, which ſo euer of them you ſeeke, the ſigne and degree wherein the ſaid Planet or Dragons head is the ſaid day at noone tide.

And to find out the aſpects which the Moone hath with any of the Planets the ſame day, you muſt reſort to the other Table on the right hand, obſeruing like order as before.

The Example.

As for example, the 21. of Aprill 1592. which is the firſt of May according to the Romane accompt, I find by the Table on the left hand. the Sunne to be in the 10. degree 15. minutes of Taurus, the Moone to be in the third degree 47. minutes of Capricorne, Saturne to be in the 8. degree 10. minutes of Cancer, Iupiter to be in the 18. degree 28. minutes of Sagittarius, Mars to be in the 12. deg. 6. minutes of Gemini, Venus to be in the 2. degree 0. minutes of Aries, and Mercurie to be in the 6. degree 20. minutes of Taurus, & the head of the Dragon to be in the 29. degree 45. minutes of Gemini. And right againſt this in the Table

on

on the right hand, you shall finde the Moone to be in a trine aspect with the Sunne, to bee in an opposition with Saturne, to bee in a trine aspect with Mercurie.

Thus much touching generall Kalenders or Almanackes. Now as for particular Kalenders I take that which Robert Norman hath set downe in his new Attractiue to be the fittest for our countrie men, which containeth many necessarie thinges, as the contents thereof together with the Table next following the same doth shew, which Kalender I thinke it superfluous to be set downe againe here, and the rather for that I wish euery Mariner not to be without that booke, and especially containing besides the Kalender many other good precepts touching Nauigation, to which booke is also ioyned a very learned and Mathematicall discourse touching the variation of the Mariners compasse made by Master William Borough controller of her Maiesties Nauie, who in mine opinion is one of the skilfulest men in the Art of Nauigation that is in this Realme.

Of the Mariners Ring or Astrolabe, and of his crosse staffe

Chapter. 12.

NOw according to the order set downe in the beginning of this Treatise, I must needs speake somewhat of the common Mariners Ringe or Astrolabe, and of his crosse staffe which serue not to so many purposes as that of Stofflerus or of M. Blagraue before described, but onely to take the altitude of the Sunne, or of any Starre or Planet, neither are so many conclusions to bee wrought by their common crosse staffe as by that of Gemma Frisius, or by that which Master Hood hath lately inuented. Sith our Mariners for the most part doe vse their common crosse staffe to none other ende but either to take the altitude of the Sunne or of any fixed Starre or Planet, or else to take the distance betwixt two starres, the making of which staffe is plainely set downe by Martin Cortes in his Arte of Nauigation, and also the making of their Astrolabe.

But Cogniet and Wagoner do set downe a new kinde of crosse staffe,

staffe, hauing 3. transames or crosses euery one longer & shorter than nother by the one halfe, affirming that so many conclusions may be wrought therby as by that of Gemma Frisius, but in mine opinion they are not to be compared in all respects to ỳ of Gemma Frisius, which though by reason that the yarde thereof is of so great a length as it is not maniable in a ship, yet vpon the land it is most seruiceable nor yet to that of M. Hoods inuention, which is most maniable, and therewith very light of carriage, by whose staffe I thinke verily that as many things may be wrought as by any other kind of crosse staffe whatsoeuer, and with lesse trouble, yea, and in maters of Astronomie more truely by reason that the yard and transame be of one selfe length, and thereby the degrees be larger throughout the whole quadrant than they be in the common crosse staues, for in them, the degrees frō 50 vpwards to 90. are very smal & haue narrower spaces than M. Hoods staffe hath. Againe, whereas in vsing the Mariners crosse staffe in such Latitude, as the Sunnes beames be of great force, they are faine to haue glasses made of purpose to saue their sight, and in some places all too little. But in vsing M. Hoods staffe they shall not néd to behold the Sunne it selfe at all, but onely to marke vpon what degree of the yarde the shadow of the Vane streeketh. Moreouer, when the Sunne or starre is 50. or 60. degrées high, they are faine to vse their Astrolabe and not their staffe, which Astrolabe in mine opinion, as I haue saide before, is the best instrument of all others to take the altitude of the Sunne in the day, or of any starre in the night, and because I haue here commended vnto you M. Hoods staffe, I will first set downe a plaine description thereof together with those few Astronomicall vses which doe chiefly belong to the Mariner, without committing any offence I hope to the Author thereof, and then I will describe vnto you the Mariners ring and his common staffe together with the vses of the same.

But as I was about to describe vnto you M. Hoodes staffe, a friende of mine comming in the meane time desired mee that I would first set downe the making and vse of the crosse staffe with three Transames, which Wagoner and Michaell Cogniet doe so much commend, & as I heare, is vsed of many sea men in these dayes, whose request I could not well denie, and therefore loe here followeth both the making and vse thereof.

Of

Of the croſſe ſtaffe hauing three Tranſames or Courſours, commonly vſed in theſe daies, the vſe and making whereof doth hereafter follow according to the deſcription of *Wagener* and *Michaell Cogniet*.

FIrſt prepare a right ſtaffe of firme woode that is ſquare euery way, bearing in thicknes 3. quarters of an inch, & in length three or foure foote, for which you muſt alſo prepare three tranſames or Courſours, euery one ſhorter the another by the one halfe, for the longeſt would containe in length twelue inches, the ſecond ſixe inches, and the ſhorteſt or leaſt three inches. And euery one of theſe Tranſames or Courſours muſt be cut with a ſquare hole in the very middeſt, ſo as they may be made to run iuſt vpon the ſtaffe to and fro. theſe things being prepared, you muſt deuide three ſides of the ſtaffe into certaine degrees to ſerue the three ſeuerall Courſours as followeth.

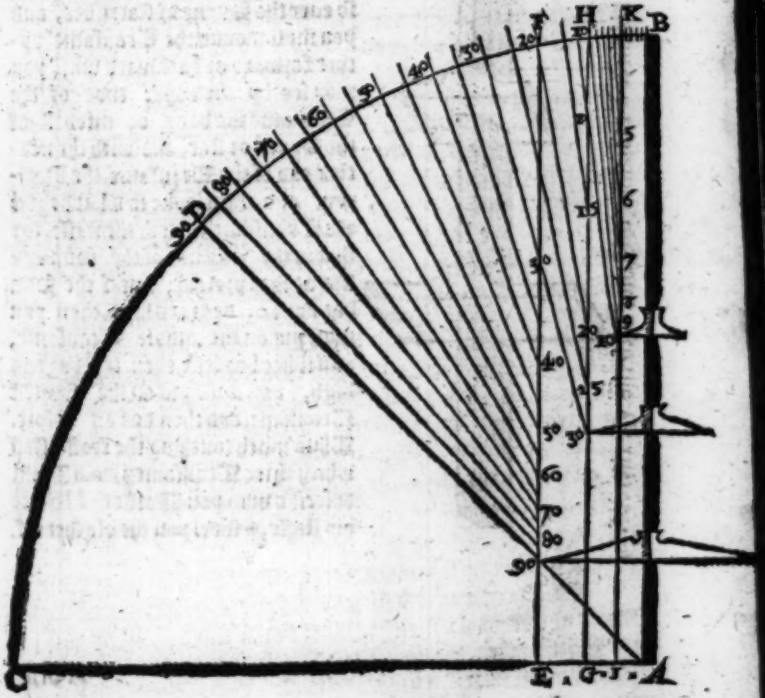
Firſt you muſt vpon a ſmooth ſquare Table ſomewhat longer euery way then the ſtaffe, and for want of one ſuch Table you may ioyne two Tables that may ſtand euen together, drawe by helpe of a true long ſquire a right Triangle marked with the letters A. B. C. and let A. be the right Angle, and the Centre as you ſee in the figure following, and let both the ſides of the ſaid Triangle be of like length to your ſtaffe, then putting the one foote of your Compaſſe in the Centre A. and the other foote in B. or C. drawe a quarter of a Circle from C. to B. and hauing deuided that quarter into two equall parts, make a pricke in the middeſt marked with the letter D. and laying your ruler to that pricke and to the Centre A. drawe a right line which ſhall bee A. D. then deuide the halfe Quadrant D B. into nine equall parts making 90. equall degrees proceeding from B. to D. ſo as the firſt degree may be at B. and the 90. at D. that done, take with your Compaſſe the iuſt halfe of the longeſt Tranſame, and keeping your Compaſſe at that wideneſſe, ſet the one foote in the Centre A. and the other foote in the line A. C. ſo farre as that wideneſſe will extende, and there make a pricke marked with the letter E. then from that point drawe a right line that may be a Pa-

rallel to the line A. B. which line shall be F. F. then take with your compasse the halfe of the middle Transame, & keeping your Compasse at that wideneſſe, ſet the one foote in A. and the other foote in the line A. C. ſo farre as that wideneſſe doth extend, and there make a pricke marked with the letter G. & from that pricke draw a right line that may be a Parallel to A. B. which line shall be G. H. Thirdly take the one halfe of the leaſt Transame with your compasse and transferre that wideneſſe to the line A. C. ſetting the one foote of your compasse in A. & make pricke with the other foote in the line A. C. as before, marked with the letter I. and from that pricke draw another right line that may be a Parallel to the line A. B. which shall be the line I. K. Now to graduate the first side of your staffe to ſerue the longeſt Transame, you muſt lay the ruler to the centre A. and drawe right lines from thence to euery degree of the circumference contained betwixt 90. and 30. & thoſe lines shall deuide the line E. F. into ſo many vnequall ſpaces as doe belong to the firſt ſide of the staffe, for you muſt lay the firſt ſide of the staffe to that line to be marked according to the diuiſion of that line, the neather ſection whereof towards the lower ende of the staffe muſt be marked with 90. and the vpper ſection with 30. ſo is the firſt ſide of your staffe truely deuided to ſerue the longeſt Transame, now to ſerue the middle Transame you muſt deuide the line G. H. by drawing right lines from the Centre A. to euery degree of the circumference contained betwixt 30. and 10. which lines will deuide the line G. H. into vnequall ſpaces, of which ſpaces the loweſt muſt be marked with 30. and the higheſt with tenne, according to which diuiſions you muſt marke the ſecond ſide of your staffe by laying the ſide cloſe to the line G. H. ſo shall that ſide be marked to ſerue the middle Transame, then lay your ruler againe to the Centre A. and drawe right lines to euery degree of the circumference contained betwixt 10. and the firſt or ſecond degree next to B. and thoſe lines shall deuide the line I. K. into vnequall ſpaces, the loweſt whereof is to be marked with 10. and the higheſt with 2. or 5. according as your inſtrument will beare, and according to thoſe ſections you muſt deuide the third ſide of your staffe by laying the ſame cloſe to the ſaid line I. K. and remember to make your lines of diui-

ſion

sion so finely as is possible, so shall your staffe be the more truely graduated. And note that in graduating your staffe, you shall not neede to drawe right lines from the Centre to euery degree of the circumference contained betwixt the 90. degre & the 60. degree, for when the Sunne or any starre is higher then 60. degrees, you must vse your Astrolabe and not your staffe which will not serue you to looke so right vp to take so great an altitude either of Sun or starre

A figure of the foresaide Triangle.





The shape of the staffe with his three Transames, together with the vse thereof.
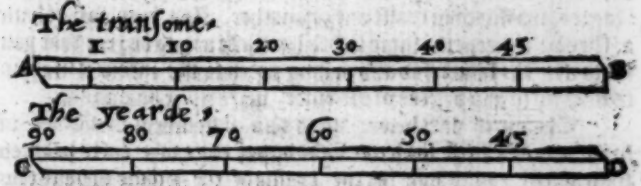
Whensoeuer you would take the Altitude of the Sunne or of anye Starre, you haue first to consider whether the Sunne or starre be 30. degrees or more high: for then you must place the longest Transame vppon your Staffe. And set the lower ende of your Staffe markes with nintie to your eye, which is alwayes to be done how high or lowe so euer the Sunne or starre bee, and you must moue the Transame eyther forward or backward vntil you may see by the vpper ende of the Transame the body or middest of the Sunne or star, and with the neather end of the Transame the Horizon, and then looke in what degree the Transame cutteth the staffe, for that is the Altitude of the Sun and star at that present, but if the Sun bee not 30. degrees high, then you must put on the middle Transame, and if hee bee lesse then ten degrees high, you must put on the shortest Transame, and then doe as before. Thus much touching the crosse staff whith three Transames, now I will describe vnto you Maister Hoode his staffe, & shew you the vse thereof.

A briefe

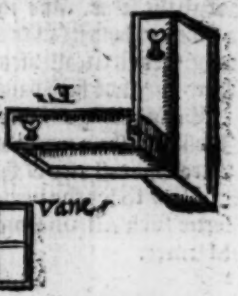
A briefe deſcription of Maiſter *Hoode* his croſſe ſtaffe, and of all the partes thereof.

Chapter. 13.

The figure or ſhape of euery part of the ſaid ſtaffe.



THis inſtrument as you ſe conſiſteth of foure parts. Firſt of 2. ſquare rulers ech one bearing in thicknesſe three quarters of an inch or there abouts euerye waye ſquare, and in length I would wiſh each ruler not to containe aboue one yarde, for then in ſome vſes they would ware to ppe heauie.



Of which two rulers the one marked with the letters A.B. is called the Tranſame, which is diuided on the one ſide into 45. degrees beginning at one and ſo forth to 45. And euery degree is diuided againe into fiue leſſer parts making 60. minutes, for fiue times ten maketh 60. which ſerueth for Aſtronomicall vſes.

And on the oppoſite ſide to that, the ſaid Tranſame is diuided into 1000. equal parts beginning at 25. and ſo increaſeth by 25. vntill you come to 1000. Euery which 25. partes is diuided into fiue leſſer partes, & euery one of thoſe againe into fiue parts, which maketh in all 25. for fiue times fiue is 25 and this ſerueth for Geometricall vſes.

The

The other ſquare ruler called the yarde & marked with the letters C.D. is deuided into degrees like to thoſe of the Tranſame proceeding from 45. to 90. which together with thoſe degrees that be in the firſt ſide of the Tranſame doe make vppe the number of a iuſt Quadrant to ſerue Aſtronomical vſes. And the ſide oppoſite to that is deuided into 1000. degrées proceeding from 25. to 025. like in all reſpects vnto the oppoſite ſide of the Tranſame to ſerue Geometricall vſes.

The third part belonging to this inſtrument is a double ſocket of braſſe marked with this letter E. ioyned together with right Angles, and ſtanding croſſe one to another. And each ſocket hath a ſkrewe to keepe the ſame faſt to his ſtaffe at any degree that you liſt to ſet the ſame: And alſo a long notch to the intent it may be laide cloſe to any degrees of the ruler whereto it belongeth.

The fourth part belonging to this inſtrument is a Vane of braſſe marked with the letter F. the vpper edge whereof is pearced with a little round hole for the beame of the Sunne to paſſe thorough the ſame. And this Vane is made with a ſocket and with a ſkrew to hold it faſt to that ruler whereon it is ſet. And for certaine Geometricall vſes it were neceſſarie (as ſome thinke) that there were two ſuch vanes.

Thus hauing deſcribed all the parts of the foreſaid inſtrument I will now ſhew you how to ſet thoſe parts together which to ſerue Aſtronomicall vſes is thus done.

How to ſet the partes of Maiſter *Hooder* ſtaffe together to ſerue ſuch Aſtronomicall vſes as doe chiefely belong to the Mariner.

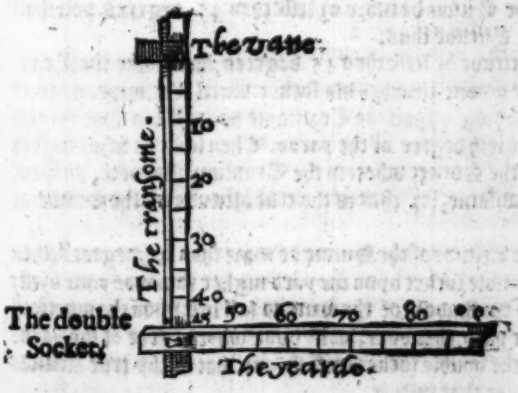
Chapter 14.

FIrſt put the neather end of the Tranſame marked with the 45. degree into the double ſocket, ſo as the Tranſame may ſtand right vppe, and that the notch of the ſocket may meete euen with the ſaide 45. degree, and turne the ſkrew that the ſocket may ſtand faſt at that degree, that done put the yarde into the croſſe ſocket, ſo as the notch of the ſayde croſſe ſocket may lie iuſt vppon the 45. degree of the yearde, and there make

make it fast by turning the skrewe: then put in the vane, which to serue Astronomicall vses must be set at the highest ende of the Transame, in such sort as the vpper edge of the vane pearced with the hole may stand euen with the first point or streke of the said Transame, & when the Transame standeth on the left hand of the yarde, then the vane must be placed on the right side of the transame: But if the Transame do stand on the right hand of the yard, then the vane must be placed vpon the left side of the Transame: And the yard and Transame would be so set together as the degrees of the Transame proceeding downeward from one to 45. may looke towardes you, that is to say, may stand right before your face: And the degrees of the yarde proceeding from 45. to 90. would lie vpward, so as the end of the yarde marked with 90. may point to your breast or be set to your eye as occasion shall require, for such Astronomicall vses as here doe follow.

The shape or figure of the foresaid staffe, hauing all his parts set together to serue for Astronomicall vses.

Chapter. 15.



How

How to take the altitude of the Sunne at any houre that he is to be ſeene with the eye by M. Hoods ſtaffe.

Chap. 16.

THe Staffe being ſet in ſuch order as is before taught, goe into ſome open place whereas you may ſee the Sunne, and turning the ende of the yarde marked with ninetie towards your breſt, holde the yarde ſo leuell as you can, that it may be a iuſt Parallell to the Horizon, and turne both your faces, and alſo the vane of the Tranſame towardes the Sunne. Then you haue to conſider whether the ſunne at that preſent be either iuſt 45. degrees high, or more, or elſe leſſe then 45. degrees, which you ſhall eaſily know thus: For if he be iuſt 45. degrees high, then the ſhadowe of the vpper edge of the vane will ſtreeke iuſt vpon the 90. degrees of the yarde lying at your breſt: But if he be more then 45. degrees high, then the ſhadowe of the vane will ſtreeke ſhort of the 90. degree: And if it be leſſe it will caſt no ſhadow at all vpon the yarde, but ſtreeke cleane beyond it ouer your ſhoulder. Now knowing by this meanes whether the altitude of the Sunne be more or leſſe then 45. degrees, you ſhall take his true altitude thus:

If his altitude be leſſe then 45. degrees, then make the Tranſame to ſinke downe through his ſocket vntill the vpper edge of the vane ſtanding vppon the Tranſame doe caſt his ſhadow iuſt vpon the ninetieth degree of the yarde. Then looke at what degree the notch of the Socket wherein the Tranſame ſtandeth, doth cut the ſaid Tranſame, for that is the true altitude of the Sunne at that inſtant.

But if the altitude of the Sunne be more then 45. degrees, then drawe the double ſocket vpon the yard nigher towards your breſt: vntill you ſee the ſhadow of the vane to fall iuſt vpon the ninetieth degree of the yard, that done, looke vpon what degree of the yarde the notch of the double ſocket cutteth, and that is the true altitude of the Sunne at that inſtant.

How

How to take the altitude of any ſtarre with Maiſter *Hoodes* ſtaffe.

Chapter. 17.

THere is no difference betwixt the order of the taking the altitude of the Sunne and of any ſtarre, but onely that in taking the altitude of anie ſtarre, you muſt ſet the ende of the parde marked with the 90. degree to your eye, ſtaying the ſame vpon the vpper boone of your cheeke, and that in ſuch ſort as you may ſee the ſtarre by a right line paſſing from the ende of the parde, lying at your eye to the vpper edge of the Vane at one inſtant, being alwaies ſure that the parde lie leuell, making a iuſt Parallel to the Horizon, which Horizon is more eaſie to bee ſeene vpon the ſea then vpon the land, for on the ſea there neither hils nor trees to hinder the ſight thereof.

How to take the diſtance betwixt two ſtars with Maiſter *Hoods* ſtaffe.

Chapter 18.

THe inſtrument being ſet in ſuch order as was firſt taught: Set the ende of the parde marked with 90. at your eye: and let the other ende of the parde directly point to one of thoſe Starres whoſe diſtance you ſeeke, and turne the edge of the Vane to the other ſtar bee it on the right hande or on the left, according as you thinke good your ſelfe: Then you muſt conſider whether the diſtance of the two ſtarres be iuſt 45. degrees or more or elſe leſſe, for if it be iuſt 45. degrees, then the outward edge of the Vane, and the ende of the parde marked with 90. will bee anſwerable in your ſight to that diſtance without any more ado. But if the diſtance bee leſſe then 45. degrees, which you ſhall eaſily perceiue by your eye (for then the Starre that is on your right or left hande, will appeare within the vane and fall ſhort thereof) then you muſt thruſt downe the Tranſame in his ſocket vntill you may ſee the two ſtarres by a right line paſſing from the ende of the parde marked with 90.

and

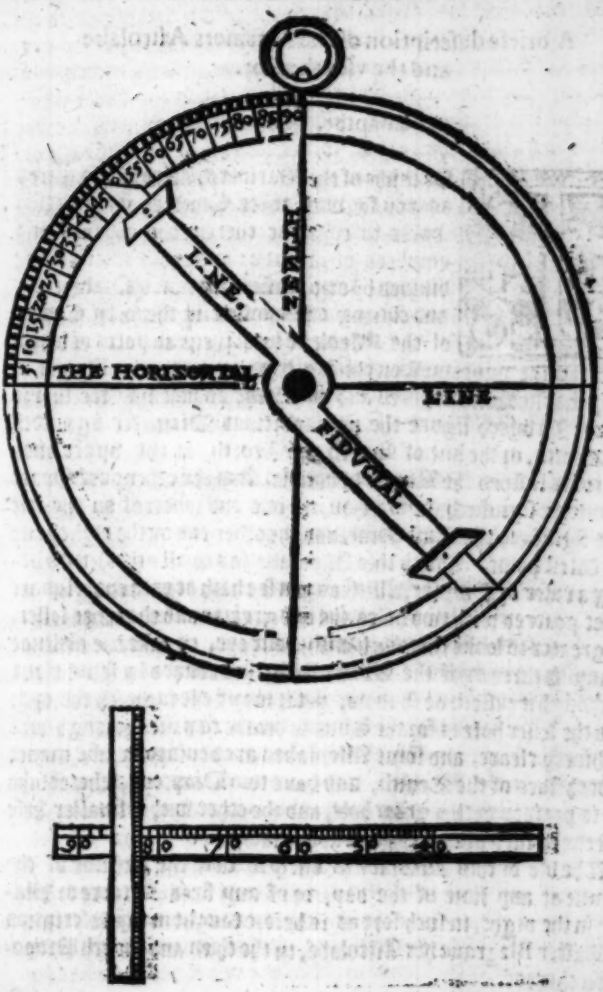
and lying at your eye, right forth to the outwarde edge of the Vane, that done, looke what degree the double socket cutteth the Transame, and that shall be the true distance of the two starres. But if the distance of the two starres bee more then 45. degrees, which you may knowe also by your eye, because the starre which is on your left or right hande, will appeare cleane without the Vane: then drawe the double socket together with the Transame towards your eye, vntill you may see the two Starres by a right line as before, and the degrees which the notch of the double socket cutteth on the yarde, shall bee the true distance of the two Starres.

Thus much touching the Astronomicall vses of M. Hoodes staffe meet for the Mariner. Now as for setting of the saide staffe to serue Geometricall vses, and to find out the manifold conclusions to be done thereby, I wholly referre you to M. Hoodes owne booke, thinking it good now to speake somewhat of the Mariners Astrolabe or Ringe, and of his vsuall Crosse staffe.

Of the Mariners Astrolabe.

Chapter. 19.

MIchaell Cogniet setteth downe the making of a new kind of Astrolabe, which he calleth an vniuersall Astrolabe, onely because the declination of the sunne euery day is added in manner of a Table to the one ende of the Diopter of the saide Astrolabe, which is of noe great importance sith the sunnes declination doth alter in the space of 30. yeares and lesse, which being expired, the declination is to be new calculated: In the meane time that Table which Norman hath set downe in his Attractiue, and also that which is more lately calculated set downe by my selfe in the first part of my Spheare, and likewise in this Treatise whereas I treate of the motion of the sunne and of his declination, may serue these 20. yeares and more without any great errour: Wherefore leauing to speake any further of Cogniet his vniuersall Astrolabe I will describe here the common Astrolabe and Crosse staffe vsed by most mariners, the shape or figure of both which here followeth


THE HORISONTAL LINE
FIDVCIAL LINE
ZENITH
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
5 10 7 6 3 2

A briefe deſcription of the Mariners Aſtrolabe and the vſes thereof.

Chapter. 10.

THe limbe of the Mariners Aſtrolabe is traced as you ſée with three Circles, making two ſpaces to containe therein the degrees and numbers of altitude: and theſe Circles are diuided by two croſſe lines called Diameters, and cutting one another in the very Centre of the Aſtrolabe into 4. equall parts of which quarters the vppermoſt on the left hand towards the Ringle is onely marked with degrees and numbers, as you may ſee in the figure: In which figure the perpendicular Diameter ſignifieth the Zenith, or the line of South and North, at the vpper ende whereof is faſtned the Ringle or handle. And the other ouerthwart Diameter ſignifieth the Horizon, the one end whereof on the left hand ſignifieth the Eaſt point, and the other end on the right hand the Weſt point. And to this Aſtrolabe (as to all other) doth belong a ruler or Diopter, which as you ſee hath at each end a ſquare tablet pearced with two holes, the one greater and the other leſſer, the greater to looke thorough with your eye, to take the altitude of any Starre or of the Sunne being ſo darkned by ſome cloud as though it caſteth no ſhadow, yet it may be ſeene with the eye: And the leſſer hole is for the Sunnes beame to paſſe thorough whē he ſhineth cleare, and ſome Aſtrolabes are deuided in like maner on both ſides of the Zenith, and haue two Diopters, whereof the one is pearced with a great hole, and the other with a ſmaller hole to ſerue to ſuch purpoſes as is aboue ſaid.

The vſe of this Aſtrolabe is onely to take the altitude of the Sunne at any time of the day, or of any fixed Starre or Planet in the night, in ſuch ſort as is before taught in my deſcription of Walter Blagraue his Aſtrolabe, in the third and fourth Propoſition thereof.

A briefe

A briefe description of the Mariners Crosse staffe.

Chapter. 21.

THis staffe consisteth of two foure square rulers of woode, whereof the one is called the parde, and the other the Transame or Crosse: And the parde containing in length most commonly three quarters of a parde is the longer peece, and is deuided into 90. vnequall degrees: for from 10. to 90. the degrees doe grow lesser and lesser, and the Transame containing for the most part but one third part of the parde, is cut with a square hole in the middest, so as it may runne vp and downe vpon the parde, & some Transames haue two running vanes to be set at what widenes you list, to take thereby the distance of any two Starres.

The vses of the Mariners crosse staffe.

Chapter. 22.

THe vse of the Mariners staffe chiefely consisteth in 2. points, that is, to know thereby the altitude of the Sunne in the day time, or of any Star in the night season, and the other is to know thereby the distance betwixt any two starres.

The first is thus done, hauing put the staffe or parde through the square hole of the Transame, set the ende of the parde, which is marked with 90. to your eye, laying that end vpon the vpper point of your cheeke bone keeping your legs close together, and hauing directed the other end of the parde towards the sunne or star whose altitude you seeke, moue the Transame to and fro or vp & down, vntill you may see with the one eye (winking with the other) the one end of the Transame to meete iust with the Centre or middest of the Sun or star, and the other end to touch the Horizon both at one instant, & that degree of the parde which the square edge of the Transame cutteth, will shew how high the Sun or star is at that present: And in taking the altitude of the Sun or of any starre, remember alwaies to hold the parde so leuell as it may be a iust Parallel to the Horizon, for so shal you take the altitude the more truly. Now as touching the second point, which is to know the true distance betwixt any two Starres you must doe thus.

Set the end of the yarde marked with ninetie to your eye as before, and moue the Tranſame to and fro vntill you may ſee the one end of the Tranſame to anſwere the one ſtarre, and the other end thereof to anſwere the other ſtarre, for that degree of the yard which the tranſame cutteth, will ſhew the diſtance betwixt the two ſtarres: And if the two ſtarres bee ſo nigh together, as they will not conueniently anſwere the two ends of the Tranſame then you may vſe the two moueable vanes, which (as I ſaide before) you may ſet at what widenes you liſt, but yet ſo as they may both ſtand equally diſtant from the Centre of the Tranſame or from both ends thereof.

Thus hauing ſhewed the vſe of the Mariners Ring and croſſe ſtaffe, I will now proceede to the other inſtruments, whereof the two Globes art part, which Globes I haue already deſcribed and ſhewed the chiefe vſes thereof in a Treatiſe by it ſelfe, and as for the vniuerſall Horologe to know thereby the equall houre of the day in euery Latitude, & alſo the Nocturnlabe to know the houre of the night, I ſhall ſpeake of the one when I come to ſpeake of the Sunne, and of the other whereas I treate of the North ſtarre and of his guards, for there I will ſet downe the figure and ſhape of ech inſtrument, and ſhew how to vſe the ſame: But the two cheefeſt inſtruments belonging to a Mariner, are his Compaſſe and his Carde, whereof I come now to ſpeake.

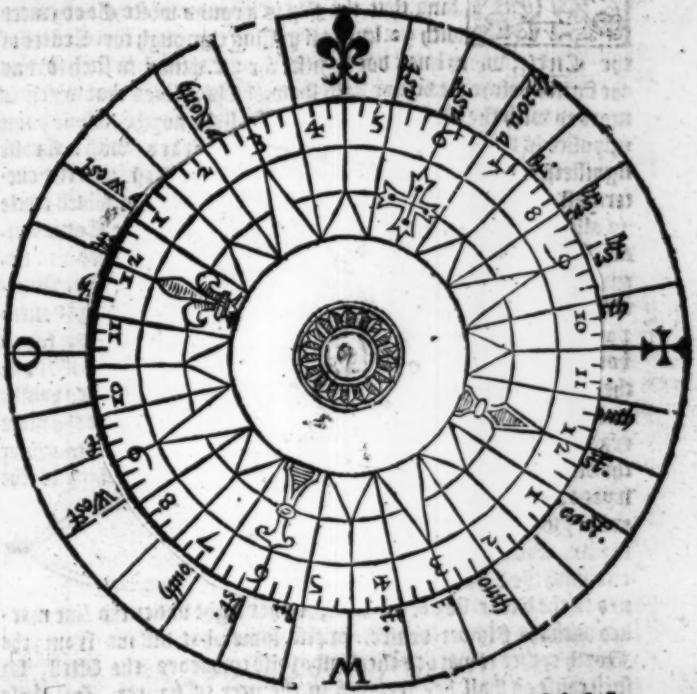
But ſith the Fly of the Compaſſe repreſenteth the 32. winds, I thinke good firſt briefly to define what the wind is, and to ſhew how many winds the ancient Mariners did vſe, I ſay here briefly becauſe I haue already ſpoken ſufficiently thereof in the latter end of my Spheare.

Of the winde, what it is, and of the diuers kindes, and names thereof.

Chapter 23.

The winde acording to Ariſtotle, is an exhalation hotte and dry, engendred in the bowels of the earth and being gotten out is carried ſidelong vppon the face of the earth. And of windes there be foure principall

ripall which doe take their names from the foure quarters of the earth from whence they blowe, that is North, South, East and West: and though the Greekes and Latines deuide euery quarter into three partes, and thereby make in all but twelue windes, whose names both Greeke and latine are set downe in the latter end of my Spheare, yet our latter Sea men to be the more assured of their Rowtes and Courses, do deuide euery quarter of the Horizon into eight windes, so as in all they make 32. windes giuing them such names as are set downe in this figure here following, representing the Fly of the Mariners Compasse.



A brieſe deſcription of the Mariners compaſſe, and the vſe thereof.

Chapter. 24.

THe Mariners Compaſſe may be very well diuided into two eſſential parts. that is, the Fly, and the wyars touched with the Lodeſtone called in Latine Magnes. And firſt you haue to vnderſtand, that the Fly is a round white Card traced with 32. lines all paſſing thorough the Centre of the Circle, which lines doe ſignifie the 32. winds in ſuch ſort as the figure before ſet downe doth ſhew, of which lines that which is marked with the Flower-delice ſignifieth the North, whoſe point oppoſite is the South, and that which is marked with a Croſſe ſignifieth the Eaſt whoſe point oppoſite is the Weſt, and the outtermoſt Circle of the ſaid Fly ſignifieth the Horizon, which circle is alſo deuided into 360. degrées like vnto thoſe of the Equinoctiall, ſo as euery ſpace betwixt point and point containeth 11. degrées 15. minutes, which is the fourth part of a degrée. Moreouer, this Circle is deuided into 24. houres by allowing to euery point three quarters of an houre, which is 45. minutes, for an houre containeth 60^{m}. and halfe an houre containeth 30^{m}. and the quarter 15^{m}. Moreouer, the common Mariners doe deuide euery point of the compaſſe into foure quarters to make the more exact account of their Routes or Rombes. But now as touching the other eſſentiall part of the Mariners Compaſſe which is the wyars, you ſhall vnderſtand that they are of yron or ſteele, and made in this forme, and being touched at the one end with the Lodeſtone, they are faſtened to the backe-ſide of the Flie, either right vnder the line marked with the Flower-delice, or elſe ſomewhat diſtant from the North eyther towardes the Eaſt or elſe towardes the Weſt, for ſuch cauſe as ſhall bee declared in the next Chapter, for thoſe wyars being thus touched, doe make that part of the Fly that is



marked

marked with the Flowre-deluce, to ſtand alwaies towardes the Northe, and to that end the Flye hauing in the Centre a latten ſocket is put into a turned boxe, in the middeſt whereof is a ſharpe pointed Latten pinne, vppon which the Flie turneth about, & that turned boxe is couered with glaſſe, partlie to keepe the Flie cleane but chiefly that the winde ſhould not moue it to and fro. And this turned boxe is hanged by two rounde narrowe plates of Latten, in another ſquare boxe of thinne wainſcot boorde, ſo as it may alwaies hang leuell, howſoeuer the ſhippe ſwayeth or inclineth on eyther ſide, and though of the Mariners Compaſſe there be diuers vſes, as you ſhall perceiue hereafter, yet the chiefeſt end and vſe thereof is to ſhew the Northe part of the worlde, whereby the Shipmaiſter knowing what courſe he hath to hold, and how the port or place to which he goeth, beareth from the place from which he departeth, may by looking alwaies to his Compaſſe, knowe howe to direct his ſhip accordingly.

Of the Lodeſtone, and of the variation of the compaſſe in Northeaſting and Northweſting.

Chapter. 25.

The Lodeſtone or Adamant, called in Latine Magnes & in Italian Calamita, hath two marueilous great and ſecret propperties or vertues, the one to drawe ſteele or Iron vnto it, and the other to ſhew the Northe and South part of the worlde, of which ſtones ſome be of more force than others according to the place from whence they come. For thoſe are counted beſt which are founde in the Eaſt Indies vppon the coaſt of China and Bengala, which is no ſhell but a whole ſtone of ſanguine colour like to Iron, and is firme, maſſie, and heauie, and will drawe or lift vppe the full waight of it ſelfe in Iron or ſteele. And as Norman ſayth in his newe Attractiue, ſuch Stones are commonly ſolde for their waight in Siluer.

Next to this, Norman commendeth the reede stone of Arabia, hee commendeth also the stone of Almayne, which is in colour like to Iron, but spongeous, and thereby lighter than the other. And as for the blacke and white stone of Elba, which is an Ilande, not farre from Piombino, he saith that the vertue thereof is but of small force, and of no long continuance. But the worst are those that come from Norway, whose colour is mixt with graye. I haue hearde that there bee of them here in Englande, but how good I knowe not, it is maruell that Norman maketh no mention thereof whose, Treatise called the newe Attractiue, together with Maister Borough his addition I would wish all that be studious in this Arte to read most diligently, for truely in mine opinion the secrets of this Stone and variation of the Compasse, was neuer better disciphered, nor by more experiences tried than it hath beene by these two men last named. The booke is most necessarie for nauigation and of an easie price, meete for euery poore mans purse, though perhaps in some poyntes not meete for euery mans vnderstanding. Now when soeuer the wyars are to be touched with this stone, they must be made verie cleane and void of all rust to the intent that the Iron may the more firmely receiue the vertue of the stone. And it is well knowne by good experience, that by vertue of the Lodestone the North point of the Compasse declineth alwayes from the true North, either to the East, or West more or lesse according to the latitude of the place wherein you are, vnlesse you be right vnder the Meridian of the Azores. And therefore most men in these parts of the worlde doe vse to set the North point of the wyers not right vnder the Flower de-Luce signifying the North part of the worlde, but rather somewhat inclining toward the East halfe a point or there about to auoide the North-easting and North-westing of the Compasse, the cause of which declination by diuers learned men hath beene diuersly taught, but not rightly as Michaell Cogniet saith, vntill Mercator found out the true cause, who first learned by the experience of one Francis of Deepe, an excellent Pilot, that in sayling vnder the Meridian which passeth through the Iles called the Azores the needle doth decline neither East nor West, whereupon Mercator

cator by calculating the variation of the Compasse at Ratisbone found that the Pole of the Lodestone ought to bee put in that Meridian which passeth through the foresaid Iles so as it may bee distant from the Pole of the world sixteene degrees, or rather as Master Borough saith, sixteene degrees and twentie two minutes, and by that calculation Cogniet hath found the variation of the Compasse at the towne of Antwerp to bee 9. degrees. And Master Borough by the helpe of the new instrument of variatiõ first made by Robert Norman, and afterward perfected by himselfe, haue found the variation for London to be 11. degrees and fifteene minutes, which is a whole point from North to East. But whensoeuer you depart from the foresaide Meridian of the Azores, bee it neuer so little, either towardes the East or West the needle will varie and decline accordingly. And his greatest declination is when you come to a full quarter of that Parallell wherein you saile, for from thence it declineth lesse and lesse vntill you come againe vnder the foresaide Meridian, which thing Cogniet doth plainely Demonstrate by this Figure here made of purpose,



In which figure the letter A. which is in the very centre of the Circle representeth the North Pole, and the right line mar-

ked with the letters C. B. ſignifieth the Meridian which paſſeth through the Iles Azores, in which line is a pointe or pricke marked with the letter D. ſignifying the Pole of the Lodeſtone, diſtant from the North Pole ſixténe degrées and a halfe. Now, if your ſhip be in the point B. then your néedle declineth on neither ſide, but pointeth right to the North Pole, and alſo to the Pole of the Lodeſtone. But if you ſayle Eaſtward and arriue to the point E. then the right line of the north is E.A. but your needle declineth on the right hand towardes his owne Pole D. which is to the Eaſt, ſo much as the Angle A.E.D. doth ſhewe. Likewiſe if you ſayle from B. Weſtward to the point F. the right line of the North ſhall bee F.A. but your needle will decline to his owne Pole D. towardes the Weſt, ſo much as the Angle A F.D. doth ſhewe. And to bee ſhort, the needle doth neuer ſhewe the right North, but onely in C. or B. to either of which pointes the nigher that you approach the leſſe your needle declineth, & the more that you go from any of theſe two pointes, the more your needle declineth either Eaſt or Weſt, but the greateſt declination thereof is in H. or G. for then you are a iuſt quarter from the foreſaid Meridian. Alſo by this Figure he plainely ſheweth that of two ſundrie Townes hauing one ſelfe Meridian, that which is neereſt to the Pole of the world hath greateſt declination. As for example, ſuppoſe the letter I. in the foreſaid Figure to ſignifie that Towne which is nigher to the Pole, and the letter E. to ſignifie that towne which is more diſtant from the Pole, both Townes being vnder one ſelfe Meridian E.A. Heare you ſee that the Needle being in E. doth ſhewe the Pole of the Lodeſtone by the line E.D. and being in I. it ſheweth the Pole of the Lodeſtone by the line I. D. Nowe according to the doctrine of Euclyde, the Angle A.I.D. is greater than the Angle A.E.D. whereby it followeth that the Needle declineth more in I. then in E. But whereas Mercator affirmeth that there ſhoulde bee a mine or great rocke of Adamant, whereunto all other leſſer rockes or Needles touched with the Lodeſtone doe incline as to their chiefe fountaine. that opinion ſeemeth to mee verie ſtraunge, for truely I rather beleeue with Robert Norman that the properties of the Stone, as well in drawing ſteele, as in ſhewing the North Pole, are ſecret vertues giuen of GOD

to

to that ſtone for mans neceſſarie vſe and behooſe, of which ſecrete vertues no man is able to ſhewe the true cauſe.

How to find out the variation of the Compaſſe in euerie Latitude.

Chapter 26.



William Borne in his Regiment of the Sea teacheth diuers waies how to finde out the variation of the Compaſſe, as well by the Sunne in the day time, as by the Northſtarre in the night ſeaſon. Firſt, thus marke at what point of the compaſſe, the Sunne riſeth & ſetteth, for if he riſeth at the Eaſt point of the Compaſſe, and goeth downe at the Weſt Northweſt pointe, then the Compaſſe is varied one whole point, that is to ſay, the North point of the Compaſſe ſtandeth North and by Eaſt. But becauſe the aire is ſeldome cleare at the ryſing and ſetting of the Sunne, you may doe thus, take with your Aſtrolabe or croſſe ſtaffe the altitude of the Sun in the forenoone, the ſooner the better, at ſome iuſt point of the compaſſe, and take againe his altitude in the afternoone, when hee is in like degree of altitude, and marke therwith at what point of the Compaſſe the Sunne hath ſuch altitude, and by the difference thereof you ſhall know the variation of the Compaſſe. As for example, you finde by your Aſtrolabe or croſſe ſtaffe, that the Sunne is 20. degrees high at the Southeaſt point of the Compaſſe, and obſeruing the ſame againe in the afternoone you finde his height to bee 20. degrees at the Weſt-Southweſt point of the Compaſſe, whereby you ſee that the Compaſſe is varied one whole point, that is to ſay, that the North point ſtandeth North and by Eaſt, and the South point is South & by Weſt. Hee teacheth it alſo another way, which is thus.

Take with your croſſe ſtaffe or Aſtrolabe the height of the Sun at noonetide, which is called the Meridian altitude of the Sunne, and thereby you ſhall haue the true Meridian of the place where

you

you are, with which Meridian if the South point of your Compasse doth agree, then your Compasse hath no variation at all, but if the South point thereof do swarue or incline on either side from the said Meridian, marke how much it differeth, & that difference will shewe you the variation. Nowe to knowe the variation of the Compasse by the Northe starre, doe thus, set your Compasse with the Northe starre, and if you find them to agree, then there is no variation, but note that this is to bee done when the twe guardes or pointers of Charles waine are right ouer or right vnder the Northe starre, for if these two starres be West from the Northe star then the Northe starre is a third part of a point vnto the Eastward of the Northe Pole, and if the said two starres be right East from the Northe starre, then the Northe starre is a third part of a point vnto the Westward of the Northe Pole.

The Compasse (as Bourne saith) doth varie most in sayling long voyages East and West, and though it varieth two or three points, yet you may know what course to holde without alteration of the Wyers any manner of way. As for example, suppose the Northeast point to stand right North, and your course is to goe right West, here in this case you may vse the South west point in steade of the West point, whereby you may perceiue, that it maketh no great matter, which point standeth due North, so as you take that pointe of the Compasse for the North, which directlie pointeth to the North. But Robert Norman and Maister Borough by the help of their new inuented Instrument of variation, doe shewe howe to finde out the variation of the Compasse much more exactly than euer it hath beene heretofore taught, which instrument together with the booke, I would wish all Sea men to haue, and therby to learne the perfect vse of the instrument, which vse that booke teacheth both plainely and learnedlie, in which book is also prooued by diuers demonstrations that there is no such attractiue point as some haue dreamed, but rather a respective point whereunto the needle of your Compasse will alwaies turne in what part of the world soeuer you sayle. But of the place where that respective point should bee, diuers learned Pilottes haue had diuers opinions, for some haue imagined it to bee in the Heauens, and some aboue the heauens, if it were in the heauens, then

the

the needle woulde dayly turne about, and alter according to the motion of that heauen, wherein the said point is, which is nothing so. And to bee aboue the heauens, it is contrarie to the olde rule of Philosophie, which sayth that Extra Cœlum non est locus, and therefore Norman and Master Borough haue great reason to saye that it is in the body of the earth beneath the Horizon, for they haue tried by diuers liuely experimentes, that the North parte of the needle of his owne accord and nature woulde alwaies decline downward if it be not otherwise counterpoised or letted, & by their demonstrations supposing the Meridian of the Azores, to bee the first or common Meridian, and also knowing the altitude of the Pole at London to be 51. degrees, 32. minutes, they finde that according to that Latitude the Pole of the Lodestone being in the vpper face of the earth, and right vnder the foresaide common Meridian, is 25. degrees 44. minutes distant from the Pole of the worlde. And the point respective to bee distant in a right line from vnder the Horizon of London 71. degrees, 50. minutes and the variation of the Compasse to bee as hath beene said before 11. degrees and 15. minutes, but to find out the true place of the respective point in euery Latitude, they say, that no certaine rules can as yet bee set downe, by reason that the Compasse doeth varie more sodenly in one place than in another, for in some place it will vary more in sayling 200. leagues than in another place in sayling 400. leagues. Againe, it will sometimes bee retrograde, for M. Borough in sayling betwixt the North Cape and Vaigates towardes the Northeast, and looking by his computation that the needle shoulde haue encreased his variation towardes the East, he found that it was sodenly turned backewarde towarde the West, notwithstanding both Norman and M. Borough do affirme that though the Compasse hath in seuerall Horizons seuerall variations, yet in any one Horizon the needle alwaies respecteth one onely pointe without alteration and that in his declining it keepeth the like order and that certainely in euery place. And although the needle of the Compasse by reason of the waightines of the Fly cannot decline downward according to his owne property, but onlie sheweth the point respective alwayes vppon the Horizon, which indeed, as they saye, is most necessarie for nauigation, yet by such

meanes

meanes and conclusions as are set downe in the foresaid booke, a diligent Pilot hauing with him a perfect stone may by exact obseruations find out the increasing or decreasing of the declination of the needle, which declination you shall find as they thinke to bee more or lesse according as the point respective is more or lesse distant from the place whereas the triall is made, which being diligently obserued in sundrie places, with the certaine variation of the needle from the Meridian, the true place of the point respective may be found out as they thinke.

But there be three causes which moue me to thinke that the respective point will neuer be truly found out. First for that the Meridian which in these dayes is supposed to bee the first Meridian passing through the Azores, and specially through the Iles S. Marie and Saint Michaell. Is not that Meridian vnder which the Mariners Compasse doth rightly point, as well vnto the Pole of the Lodestone as also to the North Pole of the world, for though Fraunces of Deepe found it so by his Compasse, yet diuers learned Pilots since his time hauing sayled vnder that Meridian, haue found the variation of their compasse to bee as much there as else where, and not rightly to point to the respective point, which is supposed to bee vppon the earth, and without such a certaine Meridian no true account from any Latitude can bee made. The seconde cause which mooueth mee to thinke as before, is for that the Compasse in some place of the Sea will be suddenly retrograde, which thing M. Bourough by his owne experience affirmeth to bee true, as is before set downe. The third cause is, for that I doe verily beleeue the finding out of the true place of the respective point to be as great a secret in nature as it is to knowe the cause why the Lodestone shoulde haue such vertue to drawe steele vnto it, and to shewe the North Pole of the world which are two secret gifts giuen to that stone of God for mans behoofe, & yet the cause thereof is not to be found but by man, though most carefully sought by the greatest Philosophers that euer were.

Of the Mariners Carde, and of the making thereof.

Chapter. 12.

THe Mariners Carde, which some call a nauticall Planisphearе, is none other thing, but a description made in Plano vpon paper or parchement of the places that be in the sea or in the land next adioyning to the sea, as points, capes, Bayes, ports, Flouds, Flandes, Rockes, Sandes, and such like. And such Cardes are either vniuersall or particular, the vniuersall Cards are those wherein are described the most partes of the world, such as is the vniuersall Carde or Map of Mercator, or of Plancius. The particular are those wherein some speciall partes of the sea and land are described. And both these kindes of Cardes are traced with certaine lines, whereof some are called Meridians some Parallels, and some the Lines of the Mariners Compasse shewing the 32. winds before described in the beginning of this Treatise. The order of making which Cards in times past was woont to be thus.

First drawe with a paire of compasses a secret circle that may be put out, so great as you shall thinke meet for your carde which circle shall signifie the Horizon, then deuide that Circle into four equall quarters, by drawing two Diameters crossing one another, in the Centre of the forelaide Circle with right Angles, whereof the perpendicular line is the line of North and South, and the other crossing the same is the line of East and West, at the foure ends of which crosse Diameters you must set downe the foure principall windes, that is, East, West, North and South, marking the North part with a Flower-delice in the toppe, and the East parte with a crosse, as you may see in the figure following. Then deuide euerie quarter of the saide Circle with your Compasses into two equall partes, setting downe prickes, in the midwest of euerie quarter, through which prickes, and also through the centre of the circle, drawe two other crosse lines, which must extende somewhat beyonde the circumference of the Horizon, which two crosse lines together with the first two crosse lines shall deuide the Circle into 8. partes, and thereby you shall haue

the

the eight principall Windes. That done, diuide euery eight part of the saide Horizon into two equall parts by drawing other two crosse lines through the Center, and extending somewhat beyond the circumference of the Horizon as before, whereby the whole circle shall be diuided into 16. partes, which shall suffice without making any more diuisions, which would cause a confusion of lines, and at the end of euery one of these 16. lines you must drawe a little Circle, whose Center must stand vppon the circumference of the Horizon, euery one whereof must be also diuided into 16. parts by helpe of the 16. lines, diuersly drawne from the Center of one little circle to another, in such order as the figure here placed more plainely sheweth to the eye, than I can expresse the same by mouth. And these little circles doe signifie 16. little Mariners compasses, the lines whereof signifying the windes, doe shew how one place beareth from another, and by what winde the shippe hath to saile. But besides those litle circles there is woont to be drawne also another circle somewhat greater than the rest vpon the verie Center of the Horizon, which Circle by reason of the 16. lines that were first drawne passing through the same, is diuided into 16. partes, and the Mariners doe call this Circle the mother compas.

Here place the Mariners Carde.

The shape & figure of the first lineaments of the Mariners Carde drawne after the old maner, and how to set downe the places of the land or sea therein.

Chapter. 28.

HOw the true setting downe of the places in the Mariners carde, as Points, Capes Bayes, Flouds, Ilands, and such like is to bee done by knowing what Latitude and Longitude euery place hath, which is to bee learned either by moderne Tables made of purpose: for the auncient Tables make no mention of any longitudes or latitudes

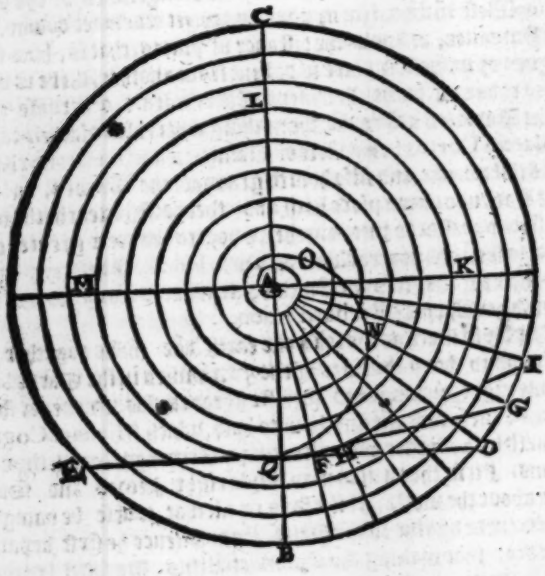
tudes of ſuch places as are in the newe found land, which land to them was neuer knowne, or elſe by ſuch Mariners cardes already made as doe ſhew the true Longitudes and Latitudes of thoſe places which you would deſcribe in your Carde, of which Longitudes and Latitudes, and eſpecially the Longitudes of the places in the Weſt Indies, few or none as are yet truely ſet downe.

Moreouer, to know the diſtance of places, that is, how many leagues or miles one place is diſtant from another, there is woont to be ſet downe in the Mariners Carde a ſcale, otherwiſe called by the Mariners a Tronke, the making whereof is plainely taught by Martin Cortes in his Arte of Nauigation, in the ſecond chapter of his third booke, and alſo how to graduate the Cardes, to ſhew what Latitude euery place hath, and there alſo he teacheth how to tranſlate one Carde into another, & how to reduce a greater carde into a leſſer, and contrariwiſe. To which booke I referre you, and the rather for that it is in Engliſh, tranſlated many yeares ſince out of Spaniſh by M. Richard Eden.

But for ſo much as the ſea & the earth doe make together one whole round body, the lines of the 32. rombes in the Carde bring drawne right, and made to ſignifie great circles, can neuer ſhewe the true courſe that the ſhip hath to hold, which Michael Cognier proueth by a Figure demonſtratiue, & thereof gathereth three concluſions. Firſt, that a man may ſayle right North and South round about the world, if the Sea in all that courſe be nauigble, and ſo returne againe to the Porte from whence he firſt departed. Secondly, that making the Equinoctiall his Parallel hee may ſayle Eaſt and Weſt round about the world, and ſo returne to the porte from whence he departed. Alſo if he ſayle Eaſt and Weſt in any other Parallel that is diſtant from the Equinoctiall, hee may returne by the ſame Parallel to the porte from whence he firſt departed, & yet not about the whole world, for that cannot be done, but onely when the Equinoctiall is his Parallel. Thirdly, that whoſoeuer ſayleth by any other rombe than by one of the foure principall, he by often changing his Meridian and Horizon muſt needs ſayle by a line Spirall, which is neither perfectly right, nor perfectly round, and thereby he may well approch the Pole, and alſo goe round about it, but yet with vnequall diſtance, ſo as he

ſhall

shall be nigher beyond it than on this side, by meanes whereof he cannot returne to the place from whence he came, as you may plainely perceiue by this Figure demonstratiue here placed.



In which Figure the letter A. doth signifie the North Pole, and the letters B. C. the Meridian passing through the Pole A. then suppose your ship to be in Q. whereas the Pole is eleuated 30. degrées and Q. to be your Zenith, and the right line G. Q. D. to be your right line of East and West cutting the foresaid Meridian with right Angles, and let D. be the East point, and E. the West point.

Now you may saile from Q. towardes the North with a South winde, and from A. you may saile againe Southwards with

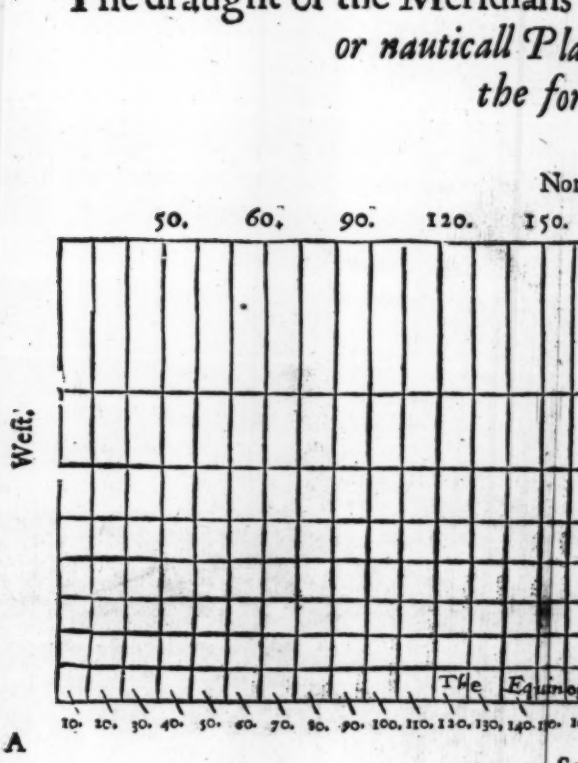
with a North winde vntill you come to the South Pole, and from thence you may saile againe Northward with a South wind vntill you come againe to Q. from whence you first departed, and so you shall haue gone round about the world vnder one selfe Meridian B. A. C. But in sayling East or West, you shall continually change your Meridian, and thereby change your East point, for in sayling from Q. towardes D. you come immediately to the Meridian A. F. whose right East point is G. and in sayling further Eastward, you come to the Meridian A. H. whose right East point is I. and so forth from one Meridian to another, notwithstanding in keeping still in one selfe Parallell marked with K. L. M. you may sayle round about the Pole A. which is the center, and so come againe to the Port Q. from whence you first departed, but not about the whole world: for that you cannot doe vnlesse the Equinoctiall were your Parallell as hath beene said before, but if you saile by any other rombe than by one of the foure principall, that is, East, West, North, or South, your course shall neither be by right line, nor yet by true circle, but by a spirall line, which is partly right, and partly rounde, so as you cannot with like course returne, to the place from whence you departed, by reason that you change so often both Meridian and Horizon, as by the Spirall line Q. N. O. drawne in this figure you may easily perceiue, which approcheth nigher to the Pole beyond it then on this side. Moreouer the sea men by making the Meridians and Parallels in their cardes all of equall distance, they make some countries farre greater then they should be by the one halfe. Also by that meanes he that sayleth East and West round about the Pole in the Parallel whose latitude is 60. degrees, should make as long a voyage as he that sayleth East and West alongst the Equinoctiall, the voyage whereof is twise as long as the other, for the redresse and remedie of which faults Cognet, hopeth to find out some more perfect rule of making Cardes when opportunitie of time shall serue: in the meane time to reforme the said faults, Mercator hath in his vniuersall Carde or Map made the spaces of the Parallels of Latitude to be wider euery one then other from the Equinoctiall towards either of the Poles, by what rule I know not, vnlesse it be by such a Table, as my friend M. Wright of

Caius Colledge in Cambridge at my request sent me (I thanke him) not long since for that purpose, which Table with his consent, I haue here plainely set downe together with the vse thereof as followeth.

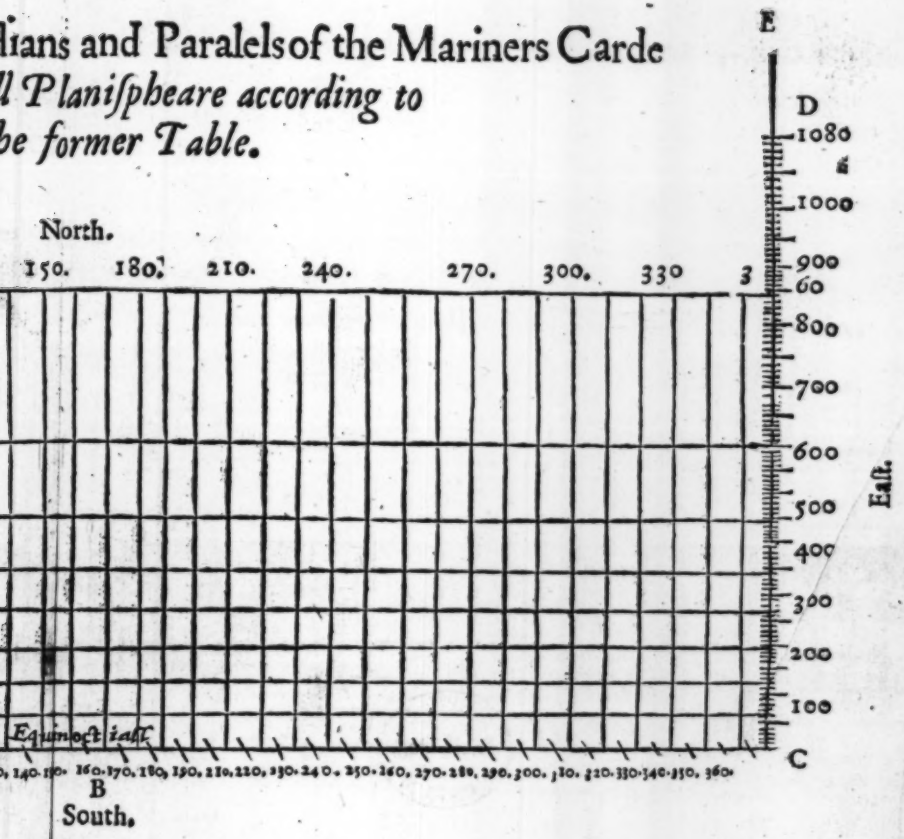
Here must you place the Draught of the Meridians and Paralels of the Mariners Carde.

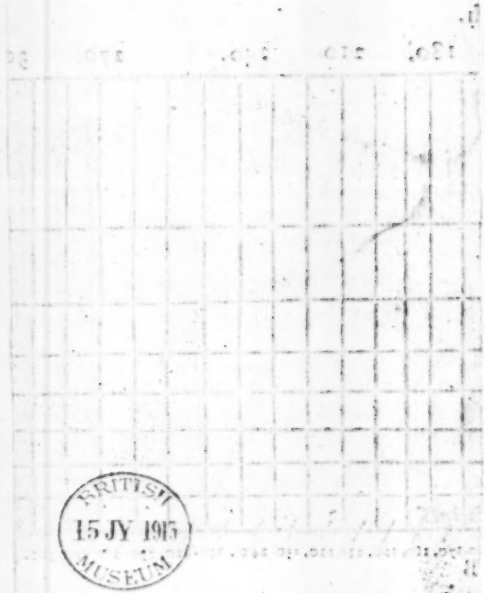
A Table

The draught of the Meridians
or nauticall Pla
the for



lians and Paralels of the Mariners Carde
l Planiſpheare according to
he former Table.





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A Table to drawe thereby the Paralels in the Mariners Carde together with the vſe thereof in trewer ſort than they haue beene drawne heretofore, and the vſe thereof.

Chap. 29.

Degrees of the Meridian beginning from Equinoctiall Circle.	Equall partes of the Meridian in the Mariners carde of which parts euery degree of the Equinoctiall containeth 60. miles	Degrees of the Meridian beginning at the Equinoctiall circle.	Equall partes of the Meridian in the Mariners carde, of which partes euery degree of the Equinoctiall containeth 60. miles
1	60	27	1684
2	120	28	1752
3	180	29	1820
4	240	30	1889
5	300	31	1959
6	361	32	2029
7	421	33	2100
8	482	34	2173
9	542	35	2245
10	603	36	2319
11	664	37	2394
12	725	38	2470
13	787	39	3546
14	849	40	2624
15	911	41	2703
16	973	42	2783
17	1035	43	2865
18	1098	44	2948
19	1162	45	3032
20	1225	46	3118
21	1289	47	3205
22	1354	48	3294
23	1419	49	3385
24	1484	50	3477
25	1551	51	3572
26	1617	52	3668

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A Table to drawe thereby the Paralels in the Mariners Carde together with the vſe thereof in trewer ſort than they haue beene drawne heretofore, and the vſe thereof.

Chap. 29.

Degrees of the Meridian beginning from Equinoctiall Circle.	Equall partes of the Meridian in the Mariners carde of which parts euery degree of the Equinoctiall containeth 60. miles	Degrees of the Meridian beginning at the Equinoctiall circle.	Equall partes of the Meridian in the Mariners carde, of which partes euery degree of the Equinoctiall containeth 60. miles
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23	1419	49	3385
24	1484	50	3477
25	1551	51	3572
26	1617	52	3668

Degrees of the Meridian, &c.	Equall partes of the Meridian. &c.	Degrees of the Meridian &c.	Equall partes of the Meridian. &c.
53	3767	67	5482
54	3868	68	5639
55	3972	69	5804
56	4078	70	5976
57	4187	71	6156
58	4299	72	6346
59	4414	73	6547
60	4532	74	6759
61	4655	75	6985
62	4781	76	6226
63	4911	77	7484
64	5046	78	7764
65	5189	79	8067
66	5331	80	8399

THe vse of this Table for making the sea Carde is thus. Ouerthwart the middest of the plaine superficies wherein you would drawe the lineamentes of the Carde, describe a right line marked with the letters A. B. C. whereof B. is the very middest or center, and this line representeth the Equinoctiall, the ende whereof on the right hande, marked with the letter C. signifieth the East, and the other ende on the left hand marked with the letter A. signifieth the West, which Equinoctiall line must be diuided into 360. degrees, then crosse the same squirewise with perpendicular lines passing through euery tenth or fifth degree, as you see in the example following. Then take with your compasses the length of halfe the Equinoctiall, that is, 180. degrees, and set one foote of your Compasses in the mutuall intersection of the Equinoctiall, and of that perpendicular or Meridian, which passeth through the East ende of the Equinoctiall line, marked with the letter C. and with the other foote make a pricke in the same perpendicular or Meridian, and marke that pricke with the letter D. that done, diuide the space contayned betwixt this pricke and the Equi-

quinoctiall firſt into three equall parts, and euery one of thoſe into other three equall parts, ſo haue you 9. parts. And againe euerie one of thoſe into three, ſo haue you twentie ſeuen parts, and diuide euery one of thoſe parts into foure parts, ſo ſhall you haue a hundred and eight parts, and if there be ſpace enough, deuide againe euery one of thoſe into ten, ſo ſhall you haue 1080. parts, and if it be poſſible, diuide againe euery one of thoſe parts into other 10. ſo ſhall you haue in all 10/800. partes, but this can hardly be done, vnleſſe the carde be very large, wherein euery degree of the Equinoctiall is neere an inch long, which happeneth very ſeldom, and therefore 1080. parts ſhall ſuffice.

And for the eaſier numbring of theſe parts, ſet to them Arithmeticall figures with blacke leade, which may afterward be put out when your worke is done, beginning at the Equinoctiall, and ſo proceede from thence both Northward and Southward, then looke what number ſtandeth right againſt euery degree in the former Table, which degrees doe extend from one to foureſcore degrees, and omitting alwaies the firſt figure on the right hand of that number which you finde, for ſo you muſt alwaies doe when your diuiſion containeth no more but 1080. parts, count that number which remaineth vpon the line of diuiſion, & there make one pricke, and make an other pricke of the ſame diſtance from the Equinoctiall vppon the outermoſt Meridian on the left hand, through which two prickes draw a right line, and that ſhall be your firſt Paralell of latitude, and ſo proceed with all the reſt firſt Northward, and then Southward, if you minde to make an vniuerſall carde. But the example following containeth no more but the one halfe of an vniuerſall carde proceeding from the Equinoctiall line Northward vnto the 80. degrees of Latitude: for further Northward than 80. degrees is no land as yet diſcouered or knowne, nor yet all that, ſo farre as euer I could learne.

IN this laſt figure or Table is firſt drawne (as you ſee) the Equinoctiall line marked with the letters A.B.C. and that line is deuided into 360. degrees, and therein alſo are drawne perpendicular lines, as well through the beginning and ending of the ſaid Equinoctiall line, as alſo through euery tenth degree thereof, which be the Meridians, and are euery where equidiſtant each one from other, then take halfe the length of the Equinoctiall which is A.B. or B.C. with your Compaſſes, and ſetting one foote in the ende of the Equinoctiall marked with C. make with the other foote a pricke at D. in the Meridian or perpendicular line marked with the letters C.D.E. then deuide the ſpace contained betwixt C. and D. into 1080. parts in ſuch ſort as before hath beene ſhewed, and ſet the Figures vnto them as here you ſee, to the intent that you may the more readily number the parts. Then looke in the firſt Table what number anſwereth to euery 10. degree of the Equinoctiall, & caſting away the firſt Figure of that number on the right hand, finde out the parts anſwerable to the number remaining in the line C.D. & at thoſe parts ſet pricks in both the outward Meridians, through which pricks you ſhall draw the Paralels. As for example, in the firſt table you ſee that the number right againſt 10. degrees is 60. (the firſt figure 3. towards the right hand being reiected) therefore looke 60. in the line C.D. and by that part drawe the firſt Paralell diſtant 10. degrees from the Equinoctiall. And after this manner all the reſt of the Paralels are to be drawne.

Many doe vſe to paint the vacant places in their Cardes with ouer many flags, and the compaſſes thereof with diuerſe and ſuperfluous colours which William Borne miſliked, wiſhing that inſtead thereof they would ſhew by letters or other Characters what Wone doth make a full ſea, in ſuch places as are neceſſary to be knowne, and alſo to draw the true ſhape and faſhion of euery Cape or headland that is needefull about the coaſt, and at what point of the compaſſe the land riſeth of this or that faſhion, for being neare the land it will ſeeme to be of one faſhion, & being farre off to be of an other faſhion, and to miſtake any place on the ſea is very dangerous to the Mariner. But aboue all thinges let him that ſayleth by Card and Compaſſe be ſure that the needle of his Compaſſe haue the like declination that his needle had which made

made the Carde. For Cogniet reporteth that certaine Mariners being in the Weſt Indies, and ſeeing the North ſtar to be Northeaſt, marualled thereat very much not knowing the cauſe of that errour, which indeed was for that the needle of their Compaſſe was made to decline Northeaſt, whereas it ſhould rather haue declined Northeaſt, for the Weſt Indies doe ſtand Weſternly from the Azores. It is neceſſarie alſo to ſet downe in the Card ſuch places as are dangerous, as ſands, flats, ſhoulds, rockes, and ſuch like things as are not alwaies to be ſeene with the eye, to the intent that the Mariner being aduertiſed thereof may ſhunne the ſame. All which thinges before mentioned, Wagoner hath in all places contained in his booke very well obſerued. Thus hauing ſpoken ſufficiently of making the Mariners Carde, now I thinke it good to ſhew the moſt neceſſarie and chiefeſt vſes thereof.

The chiefeſt vſes of the Mariners Carde.

Cap. 31.

THe chiefeſt vſes of the ſea Carde are theſe foure here following.

The firſt is to know thereby how that place whereunto you would ſaile, beareth from the place or Port from whence you ſet off, or depart. And that is to be knowne by the lines of the Mariners Compaſſes painted in the Card in this manner following: Take a paire of Compaſſes, and hauing opened them, ſet the one foote thereof in the very place from whence you depart, and the other foote in the next line of that Compaſſe which is neereſt vnto your place of departing. I meane ſuch a line as doth moſt rightly direct you to the place to which you would goe, and your Compaſſe being opened at the fit wideneſſe to ſerue that line, drawe them from the place of your departing vnto the place whereunto you would go, ſuffering the foot of the Compaſſe which ſtandeth vpon the line of the wind whileſt you draw it forward, not to ſwerue one iot from that line, and that line will eyther rightly direct you to the place aſſigned or fall ſhort thereof, or elſe ouerreach the ſame if it fall ſhort, then take another line neare to the place from which you departed, and if it ouerreach, take ſome line that is further off from the place of your depar-

ting, and hauing found a line that pointeth directly to the place, conſider what winde or rombe it is, for by that winde the place aſſigned beareth from you, and the rombe or winde oppoſite to that is the winde whereby you haue to ſayle.

The ſecond vſe is to knowe by the Card how farre the place whereto you go is diſtant from the place of your departing, which is done by helpe of the ſcale or trunke ſet downe in the Card thus: Take the iuſt diſtance betwixt the two places with your compaſſes by ſetting the one foote in the one place, and the other foote in ỹ other place, and apply that widenes of the compaſſes of the ſcale or trunke, and the trunke will ſhew how many Leagues the one place is diſtant from the other, and if the diſtance betwixt the places bee longer then the trunke, then take firſt the length of the trunke with your compaſſes, and looke how many times that is contained in the ſpace betwixt the two places, and if there doe remaine any odde meaſure, then hauing taken that odde meaſure with your compaſſes by ſetting them at ſuch widenes as is anſwerable to that odde meaſure, apply that widenes to the firſt part of the trunke, ſo ſhall you knowe the iuſt meaſure of the whole. And this rule ſerueth to take the true diſtance of any other two places whatſoeuer ſet downe in the Carde.

The third vſe is to know by the Carde what Latitude or altitude of the Pole any place ſet downe in the Carde hath, which is done by helpe of the line of degrees of Latitude, otherwiſe called the Graduation of the Card in this manner following. Set the one foote of your Compaſſes in the very place whereof you would know the Latitude, and the other foote in the line of Eaſt and weſt, which is next vnto that place, and keeping that foot ſtill vpon that line, draw your Compaſſes forward vntill you come to the line of degrees, & marke what degree of the ſaid line the foote of the compaſſe, which was firſt ſet in the place doth croſſe or touch, for that is the degree of latitude for that place, numbring from the loweſt degree of Graduation vpward, ſo ſhall you finde the Latitude of Lisbone in Portingale by Mercator his vniuerſall Carde, and by the Carde ſet downe in Martin Cortes booke, and alſo by Medina his Carde drawne in his booke of Nauigation to be 38. degrees, 30. minutes and ſomewhat more. But by the Tables of Ptolomie you ſhall finde it to be 40. degrees 24. minutes, and

by

by Appian his Tables to be 39. degrees and 38. minutes.

The fourth vſe chanceth when you are driuen out of your right course by stormes or tempest which stormes how to foresee and to prognosticate, is plainely taught by Martin Cortes in the 19. chapter of his 2. Booke. Also you may bee driuen by force of contrarie windes, by surging of the sea, or by ouerthwart tides, currants, & such like impediments, so as you cannot lay your course right to the place assigned, for remedie whereof you must seeke in what place you are, & to note the same in your Carde which as the Mariners terme it, is to make a pricke in the Carde, which to doe truely in time of neede many things are to be known & well obserued and kept in memorie. First to know what latitude the place from whence you first departed hath, then to keepe in minde what way your shippe did make good at euery shift of winde, that is to say, how many leagues, and in how long time you sailed by euery seuerall winde: and then not knowing well where you are, nor how farre you are distant from the place whereunto you would go, learne to knowe by helpe of your Astrolabe or crosse staffe, in such sorte as is before taught, the altitude of the Pole in that place where you are, which if you finde to bee all one with the Latitude of the place of your departure, then you may assure your selfe that you haue sailed by the line of East and West without altering your Latitude, but if you finde the Latitude of the place where you are, to be more or lesse then the Latitude of the place from whence you departed, then resort to your Carde, and take two paire of Compasses opened at such wideneſſe as the one foote of the one Compasse may stand in the place from which you departed, and the other foote of the same Compasse to stand in the line of the rombe whereby you sayled: and let the one foote of the other Compasse stand in that degree of Latitude which you last found, and the other foote of the same Compasse in the next line of East & West, and holding the Compasses so ordered in each hand one paire: draw them both so as they may meete together, taking good heed in drawing them, that the foote of that compasse which was placed in the line of the winde, may at no time swarue from that line, nor the one foote of the other Compasse to swarue from the line of East and West, wherein it was first placed, and whereas the two feete of those compasses doe meete,

that

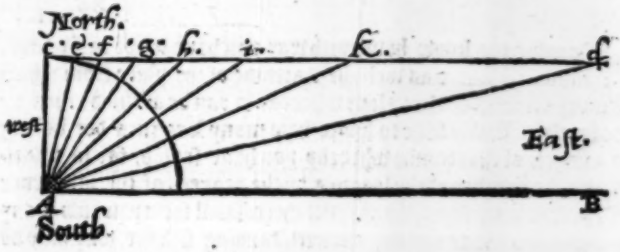
that is to say, that foote of the one Compasse which was drawne from the place of your departing doe meete with that foot of the other compasse which came from the degree of latitude last found, where these two feet (I say) do meete, there make a pricke, or marke in your Card, for that is the place where your shippe is at that instant. And from t hence you must take your right course againe to the place whereunto you would goe. But because it is necessarie as well at this time as at all other times, to knowe what way your shippe hath made, and that the same is not in mine opinion, so plainely nor so commodiously taught by any one that I haue read, as by Michaell Cogniet, I minde therefore in the two chapters next following to set downe his way not onely howe to finde out the way of your shippe when you saile South and North vnder one selfe Meridian, or in any other place where you are to change in your gate the Latitude or altitude of the Pole, but also how to finde out the way of your shippe in sayling right East and West, without changing the altitude of the Pole, which way as he saith, was neuer heretofore knowne to any Pylot, but to himselfe first author and inuenter thereof.

How to know the way of your ship, and how many leagues are to be counted for one degree in Latitude of euery Rombe whereby you sayle,

Cap. 32.

FIRST you haue to vnderstand that in sayling iust North and South, you doe alwaies abide vnder one selfe great Circle, called the Meridian, vnder the which, when you haue sailed so farre as the altitude of the Pole is changed one degree, then haue you gone 17. Spanish leagues, and a halfe, and you ha ue to note that euery Spanish league containeth 2857. fathams: & that our English league containeth no more but 2500. fathams, so as the Spanish League is more than our English League by 357. fathams, and euery fatham containeth 6. foote. Againe in sayling East and West, you doe alwaies remaine vnder one selfe Paralell, by meanes whereof the altitude of the Pole doth neuer

neuer alter, & therfore no true account can be made of the leagues, but by such meanes as Cogniet teacheth in the Chapter following. But if in sailing North and South, you decline one rombe either towards the East or West, and goe so farre as the altitude of the Pole is changed by one degree, then you haue made somewhat more than 17. Spanish Leagues & a halfe, & to be short, the more rombes that you decline towards the East or West, the more leagues in number doe belong to one degree of altitude, as you may plainely see by this figure demonstratiue here following, in which the letter A. signifieth the place or point in the carde, from which you depart scituated in the Parallell A. B.



Then suppose C. D. to be another Paralell equally distant from A. B. by one degree of Altitude. Now if you sayle right East or West, then you shall alwaies remaine in the Paralell A. B. equally distant from the Pole. But if you sayle from A. right North so farre as the Altitude of the Pole is augmented one degree, then your Shippe shall be in C. and if you saile by the first rombe towards the East so far as the Pole doth alter in Altitude, one degree, then your Ship shall be in E. and thereby your way must needes be longer, and so consequently the more rombes you decline from North to East, the longer is your way, and the more Leagues must be accounted to one degree of Altitude, as the lines drawne from A. to E. F. G. H. I. K. and D. doe shew. And what so euer is said here of the quarter from North to East, the same is to be vnderstood in all the other three quarters, that is, from North to West, from South to East, and from South to West. But if you will know how many Leagues doe belong to

euery

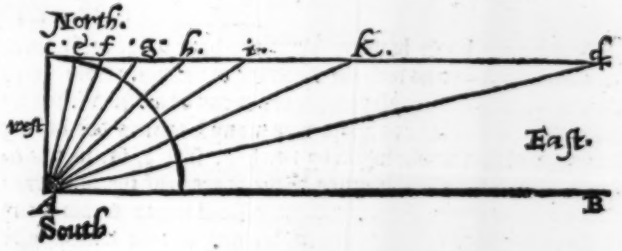
that is to say, that foote of the one Compasse which was drawne from the place of your departing doe meete with that foot of the other compasse which came from the degree of latitude last found, where these two feet (I say) do meete, there make a pricke, or marke in your Card, for that is the place where your shippe is at that instant. And from thence you must take your right course againe to the place whereunto you would goe. But because it is necessarie as well at this time as at all other times, to knowe what way your shippe hath made, and that the same is not in mine opinion, so plainely nor so commodiously taught by any one that I haue read, as by Michall Cogniet, I minde therefore in the two chapters next following to set downe his way not onely howe to finde out the way of your shippe when you saile South and North vnder one selfe Meridian, or in any other place where you are to change in your gate the Latitude or altitude of the Pole, but also how to finde out the way of your shippe in sayling right East and West, without changing the altitude of the Pole, which way as he saith, was neuer heretofore knowne to any Pylot, but to himselfe first author and inuenter thereof.

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neuer alter, & therfore no true account can be made of the leagues, but by such meanes as Cogniet teacheth in the Chapter following. But if in sailing North and South, you decline one rombe either towards the East or West, and goe so farre as the altitude of the Pole is changed by one degree, then you haue made somewhat more than 17. Spanish Leagues & a halfe, & to be short, the more rombes that you decline towards the East or West, the more leagues in number doe belong to one degree of altitude, as you may plainely see by this figure demonstratiue here following, in which the letter A. signifieth the place or point in the carde, from which you depart scituated in the Parallell A. B.



Then suppose C. D. to be another Paralell equally distant from A. B. by one degree of Altitude. Now if you saile right East or West, then you shall alwaies remaine in the Paralell A. B. equally distant from the Pole. But if you saile from A. right North so farre as the Altitude of the Pole is augmented one degree, then your Shippe shall be in C. and if you saile by the first rombe towards the East so far as the Pole doth alter in Altitude, one degrée, then your Ship shall be in E. and thereby your way must nædes be longer, and so consequently the more rombes you decline from North to East, the longer is your way, and the more Leagues must be accounted to one degrée of Altitude, as the lines drawne from A. to E. F. G. H. I. K. and D. doe shew. And what so euer is said here of the quarter from North to East, the same is to be vnderstood in all the other three quarters, that is, from North to West, from South to East, and from South to West. But if you will know how many Leagues doe belong to

euery

euery degree according to the rombe whereby you saile, then consider well this Table here following.

For in sayling from North or South, towardes East or West so farre as you come to change one degrée of Altitude of the Pole, the said degree doth require for the first rombe, &c.

The first Table.

Rombes.	Leagues.
1	17 5/6
2	18 14/17
3	21 1/3
4	24 3/4
5	31 1/2
6	45 3/4
7	89 3/4

Now then to know how much way you haue made in sayling, you must first know as well the Latitude of the place from which you departed as of that place whereunto you be arriued: then by the foresaid Table seéke to know how many Leagues doe belong to a degrée of that rombe whereby you haue sayled, for in multiplying the number of the leagues by the degrees of the difference of the two Latitudes, the product thereof will shew you how many Leagues you haue sayled, notwithstanding sith the way may be made longer or shorter by changing or shifting of the winde, it is néedfull that the Pilot haue consideration thereof, who by skilfull coniecture must sometime either adde to, or take fro according as néed shall require. Moreouer by the foresaid figure marked with letters, you may also easilie vnderstand how much you change in Longitude, that is to say, how much you are distant from the Meridian of that place from whence you departed, be it either towards the East or West, for he that saileth from the point A. as is aforesaid right North or South, he remaineth alwaies vnder one selfe Meridian: but he that sayleth by the first rombe towards the East or West so farre as he changeth one degrée of Altitude, and arriueth to the point E. is now distant from his first Meridian so much as is the space betwixt C. and E. which we finde by computation to be three Leagues and a halfe for one degree of Latitude, which amounteth to twelue minutes of a degree, and so of the rest of the rombes, as appeareth by this Table here following.

For

The second Table.

Rombes	leagues	Degrees and minutes of longitude.
first	3 1/3	0 12
second	7 1/4	0 25
third	11 1/3	0 40
fourth	17 1/3	1 0
fift	26 1/3	1 30
sixt	42 1/4	2 25
seuenth	88. 0	5 2

For in sayling from North or South towards East or West so farre as you change one degree of altitude of the pole, you change also your Meridian, and thereby your Longitude, the quantitie whereof answerable to euery rombe, is set downe on the right side of this Table.

And to make this more plaine by example, suppose that you sayle from Lisbone, which is a famous Port in Portingale, by the winde Southwest and by west, which is the fift rombe from South to West, so farre as you finde the altitude of the Pole to bee 18. degrées lesse then at Lisbone. Now if you would know how many leagues you haue sayled, and also how much the Meridian of that place is more westward then the Meridian of Lisbone, then doe thus. Looke in the first Table, and you shall finde that to one degrée of the fift Rombe doe belong 31. leagues and a halfe which leagues being multiplyed by 18. doe make in all 581. leagues and 1/2. which you haue sayled. Then looke in the seconde Table, and you shall finde for the fifth rombe one degrée and 30. minutes of Longitude, which being multiplied by 18. and a halfe do make 27. degrées and 1/2. of a degrée, for by so much is Lisbone more Eastwarde then the place where you are. And whereas the first Table is made according to the proportion of right lines, such as are commonly drawne in Mariners Cardes, Cogniet maketh another Table according to the proportion of circular lines, which for that it differeth very little or nothing from the first Table, I omit here to set it downe. But nowe because the first Table doth chiefly serue those that saile either East or West in any Parallell betwixt the Equinoctiall and the 60. degrée of Latitude or altitude of the Pole: And that from thence forth by reason that they sayle by more oblique and spirall Circles doe make the longer voyage, Gogniet thought good to adde a thirde Table shewing how many leagues be answerable to one degree of Altitude to those that saile either East or West in any Parallel

paralel that is betwixt the Pole & the 60. degree of altitude, which Table differeth not much from the others in the four first rombes, but in the three last, that is, in the 5. 6. and seuenth rombe it differeth greatly, and most in the seuenth, as you may easily perceiue by comparing this and the first Table together.

The third Table.

	Deg.	M		Leagues
The first rombe hath	1	1	Which according to the proportion of 17. leagues & a halfe, for one degree doe make for euery rombe so many leagues as this Table sheweth	17 19/24 2/3
the second romb	1	5		18 5/24
the third rombe	1	12		21 0
the fourth rombe	1	62 6		25 1/12
the fift rombe	1	50		32 1/13
the sixt rombe	1	42		47 1/4
the seuenth rombe	5	44		100 1/5

How to account the leagues in sailing directly East or West without changing the latitude or altitude of the Pole.

Cap. 33.

IN sailing right East and West, you continue still in one selfe Parallel without making any change of Latitude. Most men therefore thinke it is impossible for you to make any true account of the leagues but onely by coniecture, for remedie whereof Cogniet hath inuented a rule most certaine, as he saith, the foundation wherof is thus, First you must suppose the Meridian of that place from whence you depart to be a firme & fixed point, and to be the very beginning of that parallel wherein you sayle, then you must know what houre is aswell at the place from whence you first departed, as also at the place whereunto you are arriued, & hauing the difference of the houres, you must know how many leagues euery houre yeeldeth according to the parallel of that altitude of the

Pole

Pole vnder which you saile, so shall you easily know how many Leagues you haue sayled. This foundation being first laid, Cogniet setteth downe this generall rule in this manner following: Whensoeuer you haue to sayle (saith he) right East or West, you must first prouide your selfe of these two thinges, the one is of an Astronomicall ring that may truly shew the houre at any time: In steade whereof I thinke it better to haue an vniuersall Dyall, such a one as is described by William Borne in the one and twentieth Chapter of his Regiment: the other thing is to haue a true houre glasse that will run continually foure and twentie houres, and therefore had neede to be three times more long and large then common houre-glasses be, whereof the glasse makers can quickly prouide you, and because the ship leaneth sometime on the one side and sometime on the other, it shall be needfull to hang the said houre-glasse with ringes of brasse or latten, to the intent that it may alwaies hang leuell like as the Mariners Compasses are wont to be hanged in their bores. Now being thus prouided of these two instruments, you must at your departing prepare your houre-glasse, that is to say, you must set it a running iust at noone when the sunne is right South, not forgetting to turne it in your voyage once a day in the very instant that it is ready to runne out. Then hauing sayled certaine daies, and being arriued at the place where you would know what way you haue made, looke to your houre-glasse, and tarrie vntill it be full runne out, at which instant seeke to know what houre it is by your Astronomicall ring, or rather by the vniuersall Dyall, for if you sayle East, you shall finde it to be past noone, but if you sayle West, then it will want of noone, and keepe those houres in minde that you may know how much it is more or lesse then noone, for those houres by shewing the difference of the houres, that are betwixt the Meridian of the place from whence you departed, and the Meridian of the place whereto you are arriued, will certifie you with the helpe of this Table here following, what quantitie of way your shippe hath made.

A Table

A Table to helpe you to know what way your ſhip hath made in ſayling right Eaſt or Weſt without changing your latitude, together with a briefe deſcription and vſe thereof.

De. of Latit.	Leagues.	De. of Latit.	Leagues.	De. of Latit.	Leagues.	De. of Latit.	Leagues.
0	262 1/3	23	241 1/3	46	182 1/4	69	94 1/3
1	262 5/12	24	239 3/4	47	179	70	89 5/8
2	262 1/4	25	238	48	175 1/2	71	85 1/2
3	262 1/8	26	236	49	172	72	81
4	262	27	234	50	168 1/2	73	76 2/3
5	261 1/2	28	231 7/8	51	165	74	72 1/3
6	261	29	229 1/2	52	161 1/2	75	68
7	260 1/3	30	227 1/4	53	157	76	63 1/3
8	259 7/8	31	225	54	154 1/4	77	59
9	259	32	222 1/3	55	150 3/4	78	54 1/2
10	258 1/3	33	220 1/4	56	146 2/3	79	50
11	257 1/2	34	217 1/3	57	143	80	45 1/3
12	256	35	215	58	139	81	41
13	255 3/4	36	212 1/3	59	135	82	36 1/3
14	254 2/3	37	209 3/4	60	131	83	32
15	253 1/2	38	206 7/8	61	127	84	27 1/3
16	252 1/4	39	203 1/6	62	123	85	22 3/4
17	251 1/8	40	201	63	119	86	18 3/8
18	249 3/4	41	198	64	115	87	13 3/4
19	248 1/4	42	195	65	111	88	9 1/4
20	246 3/4	43	192	66	106 3/4	89	4 2/3
21	245	44	188 3/4	67	102 1/3	90	
22	243 1/2	45	185 1/2	68	98 1/4		

This Table as you ſee conſiſteth of foure collums, in euery one whereof are ſet downe on the left hand the degrées of Altitude of the Pole, and next to that on the right hand the Leagues anſwerable to euery degree, the vſe whereof is thus: Firſt ſeeke out

in the ſaid Table ỹ degree of altitude belonging to that Parallel vnder which you ſayled, and next to that on the right hand you ſhal find the number of leagues incident to that degree: which number of leagues, if you multiply by the number of houres before found, the product therof will ſhew you how many leagues you haue ſayled. And if there be any minutes annexed to the houres, thē multiply alſo the number of the foreſaid leagues found in the Table by thoſe minutes, & diuide the product thereof by 60. and the quotient ſhall be leagues, which you muſt adde to the former leagues, & the ſumme thereof wil ſhew how many leagues you haue in all ſayled.

An example of counting the way of your ſhippe in ſayling right Weſt.

Chapter. 35.

SUppoſe that you haue to ſayle from the Cape Saint Vincent in Spaine right Weſt, and therefore you prepare your houre glaſſe as it may begin to run iuſt at noone, and hauing ſayled 8. or 9. daies, (not forgetting once euery day to turne your houre-glaſſe) you doe arriue at one of the Iles of the Azores called S. Mary, and there hauing tarried vntill your houre-glaſſe be cleane runne out, and ſeeking to know at that inſtant by your Aſtronomicall ring, or by ſome vniuerſall Dyall what houre it is, you finde that it is a 11. of the clocke and 10. minutes paſt, which wanteth 50. minutes of iuſt noone, and that is the difference betwixt the two Meridians, that is to ſay, the Meridian of Cape S. Vincent, and the Meridian of the Ile of S. Mary, both which places being in one ſelf Parallel muſt néedes haue one ſelfe Latitude or altitude which is 37. degrees, which altitude being found in the Table in the ſecond collum on the left hand, you finde there alſo hard by it on the right hand 209. leagues and $\frac{1}{4}$. of a league, for euery houre of that Parallell, which number of leagues, if you multiply by the foreſaid 50. minutes, the product ſhall be 10487. $\frac{1}{2}$. which if you deuide by 60. you ſhall finde in the quotient 174. leagues and $\frac{19}{33}$. parts of a league, which is the iuſt quantity of your whole voyage.

Another example of counting the way of your ſhip in ſayling right Eaſt.

Chapter 36.

SVppoſe then that you haue to ſayle from the newe found land right Eaſt in the Parallell of 50. degrees: and hauing cauſed your houre-glaſſe to begin to runne iuſt at noone, you ſet forth and ſayle the ſpace of 15. daies, not forgetting euery day once to turne your houre-glaſſe. Now if at the 15. daies end, you would know how many leagues you haue ſayled, to find in your Card in what place you are, you muſt firſt tarry vntill your houre-glaſſe be cleane runne out, and at that inſtant ſeeke by your Aſtronomicall ring, or by ſome vniuerſall Dyall, to know what houre it is, which becauſe you haue ſayled right Eaſt, you find to be two houres and twelue minutes after noone, then reſorting to the Table aforeſaid, you finde in the third collum the 50. degrees of altitude, together with the number 168. leagues and a halfe, annexed to the ſaid degree for one houre of, that Parallel, which ſumme being multiplyed by two houres maketh 337. leagues, then multiply once againe 168. by the odde 1′2. and deuide the product thereof by 60. ſo ſhall you find in the quotient 33. leagues and ſomewhat more, which being added to the former ſumme 337. leagues will make in all 370. leagues and a little more, and that is the true quantitie of your voyage. And Cognier ſaith that by practizing this way of counting, you may know euery day, yea euery houre, what way your ſhip maketh in ſayling Eaſt or Weſt.

To know how much you goe out of your way in ſayling by one wrong rombe or be more.

Chapter. 37.

IF in ſayling to any place you direct your courſe either too high or too low by one rombe you looſe in euery 100. leagues 19. leagues and $\frac{1}{7}$ of a league, ſo as you goe out of your way almoſt the fift part of your voyage. And if by two rombes, then in euery hundred leagues you looſe 39. leagues, that is to ſay, you go ſo farre out

out of the right way: And if you fall three rombes out of your right course, then in euery hundred leagues you loose 58. leagues: and if you fall foure rombes, then you loose in euery hundred leagues 76. leagues: and the more rombes that you mistake in your direction, the more you wander out of your right course. Thus much touching the Mariners Compasse and his Carde: nowe wee will speake of the Northstarre, and of his guardes, and then of the Sunne and of the Moone, and so end.

Of the North starre, otherwise called the Loadstarre, and his guardes, and how to know the same, Chap. 38.

THough euery Mariner knoweth the Northstarre so soone as he seeth it in the firmament, because it is his chiefe guide to direct thereby his ship in the night season in al the North parts of the world yet euery man that is no Sayler knoweth him not, and therefore minding here to treat thereof, I thinke it not amisse first to teach him how to know it, & in what parts of the heauen it is placed, and howe farre it is distant from the North pole.

The Poets do faigne that of the 48. Images of the fired stars that bee in the heauen, which are otherwise called Constellations, there be two Beares hauing tayles, whereof the one is called the great Beare, and the other the little Beare, in euery of which are seuen principall stars: And that bright starre which is in the very tippe of the little Beares tayle, is commonly called of our English Mariners the Loadestar, of the Latines Stella polaris, of the Grekes Cinosura, and of the Arabians Alrucuba. But to know this star, you must first find out the seuen stars of the great Beare by looking towardes the North part of the firmament, of which stars foure being placed in his body, do make (as it were) a foure square, and the other three stars being placed in his tayle which is somewhat rising in the middst, doe represent the portion of a circle, the little Beare hath also the like shape, sauing that her fete & belly do turne vpwardes, so as the tippe of her tayle is answerable to the two hindermost stars of the great Beare, as you may see in these figures following.

Some doe call the great beare great Charles Waine or Wagon, and the little Beare, little Charles wain, because in each figure the foure square starres doo signifie the four wheeles, and the other three starres the 3. horses: Nowe to finde out the Loadestarre, imagine



a right line to passe through the two hindermost starres otherwise called the guardes or pointers of the great Beare, as you see here in this figure, and that line will rightly direct your eye to the Loadestarre which standeth in the tippe of the little Beares tayle, for there is no bright star that can be seene betwixt the two guards of the great Beare and the Loadestarre. Notwithstanding some doe affirme that there is another star nigher vnto the Pole then the foresaide Loadestarre, and that star is as they say no more but 50. minutes distant from the Pole: I haue heard that there is a Priest an Astrologer with the King of Denmarke, who is wont to finde out this starre by the helpe of an instrument whereby hee getteth first the sight of five other stars at one instant. which way I feare me is more troublesome then profitable, and if there were any such star indeed, and therewith so needfull and meete to be vsed as is the Loadestar, I doubt not but that some of our learned Pilots would haue found it out, and also haue had some vse thereof long ere this time. But leauing this matter I will returne to the description of our Mariners common Loadestar, and shew of what bignesse it is: also what Longitude, Latitude, declination, and motion it hath, and finally the chiefest and most necessarie vses thereof.

This

This Starre according to the ptutemicall Tables is of the third bigneſſe: and hath in Longitude 53. degrees 30. minutes counting from the firſt ſtarre of the Rams horne, whoſe place in theſe our daies is in the 27. degree 30. minutes of Aries, and by this meanes the place of Longitude of the Loadſtarre is in the 21. degree of Gemini, & his Latitude, counting from the Ecliptike line towards the North Pole of the Zodiaque is 66. degrees 0. minutes, and his declination counting from the Equinoctiall towards the North Pole of the world is 86. ſo as he is in theſe daies diſtant from the North Pole 4. degrees, ſome ſay 4. degrees and 9. minutes, but Cogniet ſaith, that he is diſtant from the pole but 3. degrees and a halfe, who findeth by the Aſtronomicall Tables that this ſtarre at the birth of Chriſt was 12. degrees 36. minutes diſtant from the Pole, and euer ſince hath gone decreaſing, and ſhaill decreaſe euery day more then other, vntill it come to be but 26. minutes diſtant from the Pole, which is as nigh as it can approch to the Pole, for then his diſtance ſhall beginne againe to encreaſe. This ſtarre maketh his daily reuolution from Eaſt to Weſt in 24. houres, as all other ſtarres doe by vertue of the firſt moueable, but his circuit is ſo ſmall, and his gate ſo ſlow, as in ỳ ſpace of 24. houres he goeth not much more then 24. degrees of the Equinoctiall, and in his turning rounde about he maketh as it were a little Circle, in the middeſt whereof is the North Pole it ſelfe, which is inuiſible and cannot be ſeene.

And though the image or conſtellation of the little Beare containeth many ſtarres, yet the ſeuen before mentioned and ſet forth in figure are moſt obſerued, of which ſeuen Starres in the little Beare, 2. ſtars called the gards of the North ſtar are to the mariners moſt familiar, for diuers reſpects hereafter declared. And of thoſe gards the one is Northerne & the other Southern, and both are ſaid to be of the ſecond bigneſſe, & yet the Southerne gard ſeemeth to the eye both leſſer & darker then the other. Of which two ſtars I thinke it not amiſſe to ſet downe here the Longitude, Latitude, and declination as I haue done before of the Loadſtarre.

The Longitude of the South garde is 100. degrees 30. minutes, whereby his place is in the ninth degree of Leo. And his latitude is 72. degrees 40. minutes, and his declination is 73. degrees, ſo as he is diſtant from the North Pole 17. degrees.

The Longitude of the Noꝛth guarde is 109. degrees 30. minutes, ſo as his place is in the 20. degree of Leo, and his Latitude is 74. degrees, 50. minutes, and his declination is 76. degrees, ſo as his diſtance from the Noꝛth Pole is 14. degrees. Thus hauing ſhewed the greatnes, the longitude, the true place, the latitude, and the declination aſwell of the Lodeſtarre, as of his two guardes, I thinke good now to ſet downe the chiefeſt vſes that ſea men haue of them.

The vſes of the North ſtarre, and of his guardes.

Chapter. 39.

The firſt vſe is to know thereby the variation of the Mariners Compaſſe.

The ſecond is to know by his guardes when the Noꝛth ſtarre is aboue oꝛ beneath the Pole.

The third is to know by the Noꝛth Star and his guardes with the helpe of an inſtrument called a Nocturlabe the houre of the night.

The fourth is to know the eleuation of the Pole. And you haue to note that the Noꝛth ſtarre and his guardes are alwaies aboue our Hoꝛizon, and doe neuer goe downe in any place whereas the Noꝛth Pole hath any eleuation, be it neuer ſo little. But beſides theſe ſtarres there be alſo in this our latitude diuers other images of ſtarres that are alwaies aboue our Hoꝛizon, and doe neuer goe downe, as the Dꝛagon, the great Beare, the image of Cepheus, of Caſsiopeia, the image of Auriga, hauing the Goat at his backe which is a faire bꝛight ſtarre of the firſt bigneſſe, and many others which I leaue to name, becauſe I haue heretofoꝛe deſcribed them all at large in my treatiſe of the Globes, by which ſtarres by reaſon that with vs they neuer goe downe, the latitude of any place and alſo the houſe of the night may be knowne ſo well as by the Lodeſtarre.

But now as touching the vſes of the foꝛeſaid ſtarres beſoꝛe mentioned, the firſt whereof ſhewing how to find out by the Lodeſtarre the variation of the Compaſſe, is taught beſoꝛe in the 25. Chapter, accoꝛding to William Bourne his rule ſet downe in his

Regi-

Regiment, and as for the other three vles they are plainely taught in the two Chapters next following.

To know by helpe of a little Table made according to the Mariners rule touching the 8. principal rombes, shewing how and when the Loadestar is eyther aboue or beneath the pole, that you may knowe thereby the true altitude of the Pole in taking the height of the Loadestarre with your Astrolabe or crosse staffe.

Chap. 40.

TO know this you must alwaies haue due consideration of the two guards of the little Beare, for when those guardes are iust Southwest from the Loadestarre, then is the Loadestarre at his heighest in the very Meridian, and therefore it is right aboue the Pole, and when those guards be iust Northeast from the Loadestar then the Loade starre is againe in the Meridian at his lowest, and thereby right vnder the Pole, and in both places his distance from the Pole is but three degrees and a halfe, as Cogniet saith: according to which account he setteth downe this Table following.

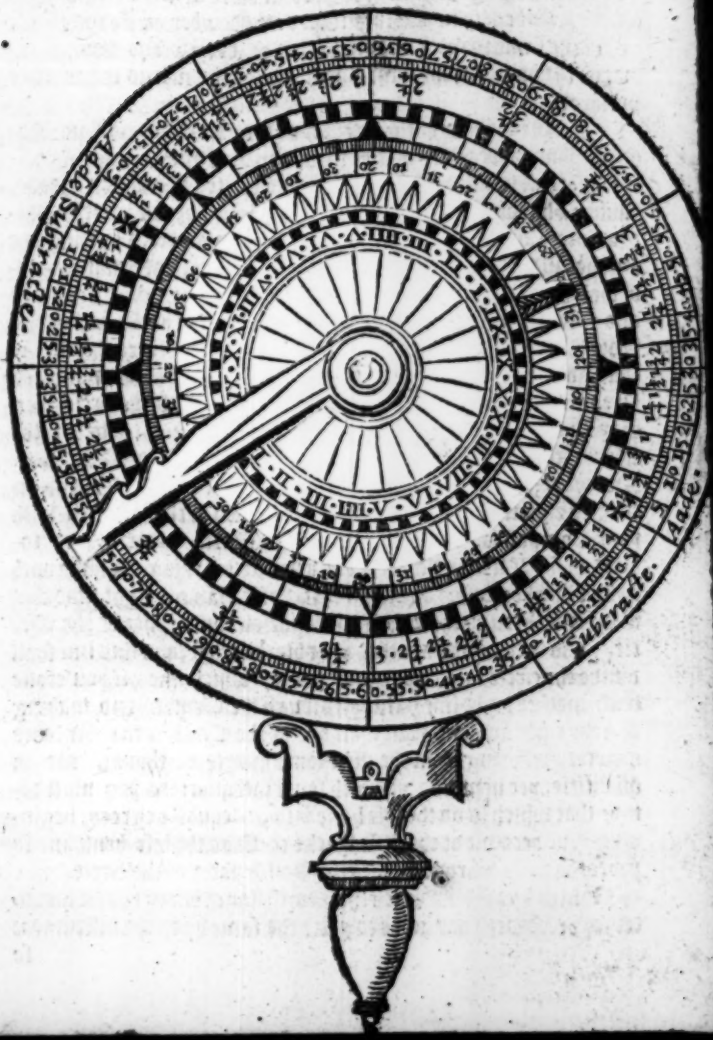
This Table is diuided into two columnes, whereof that on the left hand containeth the eight principall rombes or windes, and that on the right hand containeth the degrees and minutes of distance of the Loadestarre from the Pole, being eyther aboue or beneath the Pole.

	The rombes or windes.		The degrees and minutes of the declination of the Loadestarre from the Pole.	
If the guardes be	West	Then the Loadstar is	1 ½	Aboue the Pole.
	Southwest		3 ½	
	South		3 0	
	Southeast.		1 0	
	East		1 ½	Beneath the Pole
	Northeast		3 ½	
	North		3 0	
	Northwest		1 0	

This Table differeth in one point from the Mariners common rule set downe as well by Medina, and by Martin Cortes, as also by William Bourne touching the guards, for they all appoint but halfe a degree of declination of the North starre from the pole, the guardes being eyther in the rombe ☉ outheast, or Northwest, to both which rombes Cogniet appointeth one whole degree of declination. The vse of which table in seeking to know, the eleuation of the Pole is thus. First hauing taken with your Astrolabe the altitude of the Loadstarre aboue your Horizon, obserue immediately in which of the 8. former rombes his guardes be: For if they be in any of the 4. vpper rombes of the Table, then you must subtract from the height of the Loadstarre taken with your Astrolabe, so much as is set downe for that rombe in the collum on the right hand of the saide table, and the remaindr shall be the true, altitude of the Pole, but if the guardes be in any of the foure nether rombes, then you must adde so much to the height of the Loadstar, and the summe thereof shall be the altitude of the Pole. But because this table serueth onely for the 8. principal winds and for no more. Cogniet therefore setteth downe the making of a twofold instrument, whereby you shall not onely know (as hee saith) how much the Loadstarre is aboue or beneath the Pole in euery other rombe as well as in the 8 principall rombes, but also you shall know thereby the true houre of the night more exactly than the Nocturlabe of Munster or Appian doth shew.

How to make an instrument which wil shew at any houre of the night how much the Loadstar is eyther aboue or beneath the Pole in euery other rombe as well as in the 8. principall rombes, which are onely contained in the former Table, and also the true houre of the night, the shape whereof followeth

The ſhape or figure of the Rectifier of the North ſtar



CGnier calleth this instrument Rectificatorium Stellæ Polaris, that is to say, the Rectifier of the Nozth starre, ioyning thereunto a Nocturlabe differing nothing at all from the Nocturlabe of Munster and of others, but onely in placing the 21. of October in steade of the 28. of the same moneth vppon the line of Nozth and South towards the handle of the instrument for such cause as is hereafter declared

The making of the rectifier of the Loadstar, is thus: Vpon a smooth peece of boorde of firme wood, or vpon a peece of polished plate of brasse or Lattin being sixe or seuen inches broade, hauing a handle, as you see in the former figure, drawe a circle diuided into 4. quarters by helpe of two crosse diameters cutting one another in the center with right angles, the perpendicular whereof shall signifie the Meridian line, that is to say, the line of Nozth and South, at whose vpper end set Nozth, and at the nether end South, and the other ouerthwart Diameter shall bee the line of East and West, hauing East marked on the right hand and West on the left hand, and in euery quarter of the foresaide circle you may if you will place the like rombes that are in the Flie of the Mariners Compasse, as you may see done in the foresaid figure. Moreouer, you must diuide the vpper quarter on the left hand into three equall partes, and hauing taken two of those partes with your Compasses, measuring from the Nozth point downe towardes the West, and there make a pricke, marking the same with a little blacke crosse, and from that crosse drawe a right line that may passe through the Center vnto the circumference of the Circle, and there make another little blacke crosse, and this line shall diuide the circle into two equall parts, which line if you crosse with another right line passing through the Center, and making thereby right angles, you shall diuide the Circle into other foure quarters differing from the first foure quarters, though not in quantitie, yet in place, of which foure last quarters you must diuide that which is on the left hand into 90. equall degrees, beginning your account at the little blacke crosse on the left hand, and so proceede downward towardes the South point of the circle.

Now to know how much the Nozth star in euery rombe mounteth or descendeth and howe to place the same vpon the instrument

so

ſo as you may know how much to adde to the altitude of the Lodeſtarre, or to ſubtract from the ſame, you muſt vſe this Table following, which Table conſiſteth of two columnes, whereof that on the left hand containeth the degrees and minutes of the declination of the Lodeſtarre, proceeding from one quarter of a degree to another, vntill you come to 3. deg. and a half, which is (as Cogniet ſaith) the greateſt declination of the Lodeſtar, from the Pole: and the other columne on the right hand containeth the degrées and minutes of a quarter or quadrant, diuided by diuers and ſundry proportions of numbers into 90. degrees, which proportional degrees and minutes are to be reckoned in the firſt quadrant deuided into 90. equall degrees, & next deſcending from the firſt croſſe on the left hand thus.

The degrees and minutes of the declination of the Lodeſtarre from the Pole.		The degrees and minutes of the Quadrant, diuided by diuerſe portions of numbers into 90. degrees.	
		Deg.	Min.
	1/4	4	6
	1/2	8	13
	3/4	12	22
1	0	16	36
1	1/4	20	55
1	1/2	25	23
1	3/4	30	0
2	0	34	51
2	1/4	40	0
2	1/2	45	35
2	3/4	51	48
3	0	59	0
3	1/4	68	13
3	1/2	90	0

Firſt beginning at the ſaid croſſe, and deſcending downeward, tell out 4. degrées and 6. minutes, & right againſt that ſet downe 1/4. then tell in the ſame quadrant from the ſaid croſſe 8. degrees. and 13. minutes, and right againſt that ſet downe 1/2. and ſo proceéde according as the Table directeth you, vntill you come to 90. againſt which you muſt ſet down 3. deg & 1/2. And as this quarter is diuided, ſo you may deale with the other 3. quarters, and in each of the 2. quarters which are beneath the 2. croſſes forget not to write this word Subtract, and in each of the 2. quarters aboue the 2. croſſes write this word Adde, as you ſée in the former figure, Then there ſhall wãt nothing but only a ruler or inder, which muſt be faſtned to the center of the inſtrument, ſo as it may be turned round about a pinne hauing a round hole in it, through which you may ſée the Lodeſtar, and alſo at the ſame inſtant by lifting vp and downe.

downe the Inder you may see on the outside of the instrument the foreguard of the said Star appearing euen with the right edge of the Inder called Linea fiduciæ, or the fiduciall line drawn from the Center of the instrument alongst the inner edge of the Inder, and so is the instrument for that purpose fully perfected. But if you would adde thereunto a nocturlabe, then you must draw vpon the center thereof diuers circles next to the space containing the windes, and the spaces betwixt those circles must be some wider, and some narrower: For the first vpper space must be narrow, containing the daies of euery moneth, and the next space somewhat wider, containing the number of those daies set downe in Arithmeticall figures, and the third space wider then that, containing the names of the moneths then next to the lowest circle of the nethermost space, place a little rundle fastened to the instrument with the foresaid hollow pin, so as it may turne round about the same. And this rundle must be diuided into 24. houres, that is to say, 12. for the day, and 12. for the night, which rundle would be made with teeth, wherof one must be longer than all his fellowes signifying alwaies the 12. houre of the night, which is alwaies to be laide vpon the day of the moneth wherein you seeke to know the houre of the night. And remember in distributing the daies of the moneth, that you alwaies set the 21. of October beneath towardes the handle in the very line of North and South passing right through the middest of the handle, so shall the instrument shew the houre of the night more truely then when the 28. day of October standeth beneath vpon the line of South & North, as it doth in the common Nocturlabes, the makers whereof had respect to the Pole it selfe which is inuisible, and not to the North Starre which is apparant to the eye, by meanes whereof the guards of the Lodestarre sometime doe shew sooner or latter by seuen degrees and 18. minutes, if you count from the Pole, which is almost halfe an houre difference, and for that cause also Cogniet maketh his account in his foresaid rectifier to beginne at the little blacke crosse, seuen degrees more forward then it ought to doe, if he should count from the Pole, and not from the North Starre.

How

How to know by the foresaid twofolde instrument as well the mounting and discending of the North starre, as the true houre of the night both at one instant, and also the elevation of the Pole.

Chapter. 42.

FIrst then hauing layde and stayed the great tooth of the moueable rundle marked with 12. vppon the day of the moneth wherein you seeke, and holding the instrument by the handle with your one hand right before your face, leaue not to put that hand forward from you, or to bring it backwardes towardes you, vntill you may see with the one eye, winking with the other, the Northstarre through the hole of the pin, which is in the center of the Instrument: and so soone as you see the Northstarre light with your other hand the inder vp and downe vntill you see also at that instant the Northguarde of the Lodestar on the outside of the instrument appearing euen with the fiducial line or vnwarde edge of the said inder. Then staying the inder there looke vpon what houre it falleth, for that shalbe the houre of the night. And looke also at that instant vpon what degrée of distance it falleth in the outtermost border of the instrument, wherin these degrées are set downe together with these wordes adde and subtract. For from the point marked with a little blacke crosse nigh vnto the Northwest descending through the nether moyetie or halfe deale of the instrument vntill you come to the other blacke crosse, placed nigh vnto the Southeast, the Northstarre is alwaies aboue the Pole somuch as the inder sheweth, which you must alwaies substract from the height of the Northstarre to knowe the elevation of the Pole, hauing first taken with your Astrolabe the height of the Northstarre. But if the inder doe fall vpon any degrée or part of a degrée in the vpper moyetie or halfe deale of the instrument then to knowe the elevation of the Pole, you must adde so much as the inder sheweth vnto the altitude of the Lodestar, as the wordes Adde & Subtract written in the outermost border of the instrument doe plainely shew.

But now if you would know at any houre of the day or night.

In

in what rombe the foreſaide guardes be without ſeeing them and alſo how much the Loadeſtarre is declined from the Pole, you needs doe no more but to lay the great tooth of the mooueable rundle vpon the day of the moneth, and then to bring the inder vnto the houre which you require, and the ſaide inder will ſhew in the border of the inſtrument in what rombe the guardes be, and how much the Northſtarre is aboue or beneath the Pole.

I haue found by often triall that this inſtrument will ſhew the true houre of the night, and alſo in what rombe the guardes bee, and thirdly, how much the Northſtarre is at any time eyther aboue or beneath the Pole, and by adding the degree of diſtance found in the limbe of the inſtrument, or by ſubtracting the ſame according to the rule before giuen from that altitude of the Northſtar, which I haue before taken with my Aſtrolabe, I haue found at all times the true eleuation of the Pole where ſo euer I haue made triall thereof. But ſith other Starres may perhaps appeare when the Northſtarre with his guardes ſhall bee hidden, I would wish all carefull Mariners to acquaint themſelues with as many bright ſtars as they can, and eſpecially with thoſe which do both riſe and ſet, and alſo to learne by ſome Table the declination of euery ſuch Starre, and whether it be Southernly or Northernly, for by taking the Meridian altitude of any ſuch Starre, and by adding to, or by taking from the altitude thereof, his declination according as the ſame declination is either Northernly or Southernly (for if it bee Northernly, then you muſt ſubtract his declination, and if it bee Southernly, you muſt adde the ſame to the altitude of the Starre) you ſhall finde thereby the altitude of the Equinoctiall, which being taken out of 90. the remainder will ſhewe the eleuation of the Pole. The meeteſt Starres for this purpoſe in theſe our Northparts of the world are theſe, Hircus the Goate, Canis minor, the little Dogge, Canis maior, the great Dogge, Dexter humerus Orionis, the right ſhoulder of Orion. Cingulum Orionis, the girdle of Orion. Cor Leonis, the Lyons hart. Bubulcus, the Barewarde. Spica Virginis, the wheate eare in the hand of Virgo. Aquila volans, the flying Eagle. Caput Andromedæ, the head of Andromeda. Ras Argo, the head of Meduſa. Oculus Tauri, the Buls eye, and diuers others.

And

And in any case consider whether the declination of the Starre be greater or lesser then his Meridian altitude, for if his declination be greater then his Meridian altitude, as of those starrs which are nigh the Pole, then you must take his Meridian altitude with your Astrolabe at two seuerall times, that is to say, when he is at his highest in the Meridian, and also whē he is at the lowest point of the same Meridian called the depression, and hauing added those Meridian altitudes together take halfe thereof, & that halfe shall be the eleuation of the Pole, which way of finding out the eleuation of the Pole is nothing meete for a Mariner that is vnder sayle. But now to proceede according to Cogniet his direction in this matter, he saith, that if in sayling you approch so nigh vnto the Equinoctiall as the eleuation of the Pole is not aboue 17. degrees, then the guardes are not so easily seene, wherefore it shall be needfull to take some other starre whereby you may both know the houre of the night, and also how much the Lodestarre is either aboue or beneath the Pole, and Cogniet thinketh none of the starres more meete for that purpose then one of these two, that is, either the Star called Caput Medusæ, that is the head of Medusa called of the Arabians, Ras Algol, or else the Starre called Hircus, that is the Goat, both which are fayre bright starres and of the first bignesse: and the cause why he appointeth the head of Medusa, is for that this starre is directly opposite to the former guarde, in such sort as this starre is alwaies aboue the Horizon, when both the guardes are vnder the Horizon. Wherefore hauing prepared your instrument, that is to say, hauing laid the longest teeth of the moueable rundle vpon the day of the moneth wherein you seeke, and hauing found out thereby in such order as is before taught, the North starr and also the starr called the head of Medusa, both at one instant, marke where the Inder falleth, and immediately turne the Inder from that pointe to the point opposite, abating twelue houres, and so the Inder shall shew you three things at once. First, the rombe wherein the guardes are at that present. Secondly, the houre of the night. And thirdly how much the North starre is aboue or beneath the Pole. But because this Starre is not knowne perhaps to all Mariners, Cogniet would haue you to take the other bright Starre called Hircus, which (as he saith) goeth 9. houres and ½. before the guardes, in such sort,

wort, as when the former guarde is East, you shall find this starre counting from the Northy starre to be Northwest, and almost 45. degrees distant from the Pole, with which starre if you worke, as you did before with the head of Medusa, sauing that you shall not néede to turne the Inder vnto the opposite point, but onely to rebate from the point on which it falleth 9. houres and ½. you shall know all the three thinges last mentioned. And this rule (as hee saith) is so generall as you may haue your desire by working in like manner with any other starre that is to you certainly knowne and is at that time aboue the Horizon.

What Starres are obserued by those that sayle beyond the Equinoctiall line vnder the South Pole.

Chapter. 43.

THe ancient Astronomers as Ptolomey, Timocharres, Hyparchus and others did neuer describe any Starre to be more nigh vnto the South pole, then that which is called Canopus, which is a fayre bright starre of the first bignesse, and according to the Tables of Copernicus, is distant from the South Pole 38. degrees, and ¼. But those that haue sayled in the South seas of later daies, haue found out other Starres vnknowne to the ancient Astronomers, which are much neerer vnto the said Pole. For Albericus Vesputius writeth of three Starres, making together a Triangle Orthogonall, that is to say, hauing one right angle, now called the southerne Triangle, the middle Starre whereof is distant from the South Pole 9. degrees, ½.

There be also lately found out diuers images of other starres nigh vnto the South Pole, as that which is called Noah his Doue, or Pigeon, and another called Polophilax, made in the shape of a man, whose longitude and latitude hath not as yet beene rightly set downe by any that I haue read.

But the sea men of these present daies doe most commonly obserue foure great stars, which according to the shape and forme thereof they call the Crosse, imagining the greatest starre of the foure to be the foot, & that which standeth right ouer him, to be the head of the crosse, & the other two to be two armes: & when they

How a generall Rutter ſhewing the tydes in all places ſhould be made.

Chapter. 55.

WIlliam Borne doth ſet downe what Moone doth make a full Sea, as well heere in the moſt partes of our Engliſh coaſtes as in ſome other partes of France and Spaine, and ſo doe many others whoſe Tables touching the tides are called Rutters, whereof ſome are truely ſet downe and ſome are falſe: But ſith ſuch Rutters doe ſerue but for a few particular places I would wiſh that ſome learned Pilot that hath ſayled many and ſundrie long voyages, to make a generall Rutter that might ſerue for all places if it were poſſible, or at the leaſt for ſo many places as are knowne in theſe dayes: And I would wiſh ſuch a generall Rutter to be made in māer of an Alphabet: and that euery place might haue his true Longitude and Latitude added thereunto, to the intent that euery place might be the more eaſily found out in any Map or Carde that is graduated with degrees of Longitude and Latitude: And then to ſhewe what Moone doth make a full ſea in euery ſuch place, which thing whoſoeuer would performe, he ſhould in mine opinion deſerue great commendation. And thus I end this Treatiſe, praying al the learned Seamen not to be offended or greeued with me for that I do make young Gentlemen our owne Countrimen partakers of their moſt worthy knowledge, wherof the ignorant are not able to iudge nor to yeelde them that praiſe which they deſerue: yea rather I hope they will helpe to perfect whatſoeuer I haue herein left vnperfected, to make the young Gentlemen the more ſkilfull, & therby the more ſeruiceable to their Countrie, and in ſo doing they ſhall procure to themſelues great good will and infinite thankes.

A BRIEFE DES-

cription of vniuerſall Maps and Cards, *and of their vſe, and alſo the vſe of* Ptolomey his Tables together with the true order of making the ſaide Tables, and of all other Mappes and Cardes aſwell vniuerſall as particular, and that according to the doctrine of the beſt Geographers that be or haue beene in theſe latter daies.

LONDON
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TO THE RIGHT

VVorſhipfull M. *Francis Windam*,

one of the Iudges of her Maieſties
Court of Common
Pleas.

GOod Sir, vouchſafe to receiue this poore little Pamphlet, partly as in lieu of a richer New yeares gift, and partly as a token of my thankful mind, which is more willing th[e] able to deſerue any one iotte of the great fauour, friendſhip, and diuers benefites that I haue from time to time receiued at your hands: for want of which abilitie I neither can, nor will looſen my ſelfe from any of thoſe bonds, wherewith you haue moſt ſtraightly bound me, but rather to increaſe the ſame, humbly praying you to continue in your good loue and fauour towardes me, vntill I ſhall willingly deſerue the contrarie: In the meane time I pray God to proſper you in all your doings, and long to preſerue you.

From my poore Swans neſt. 17 December. 1588

Your olde welwiller, bound to be alwaies
at your commaundement.

Thomas Blundeuil.

To the Reader.

I Dayly see many that delight to looke on Maps, & can point to England, France, Germanie, & to the East and West Indies, and to diuers other places therein described: but yet for want of skill in Geographie, they know not with what manner of lines they are traced, nor what those lines doe signifie, nor yet the true vse of Mappes in deede: Wherefore some what to instruct those that haue not studied Geographie (without the knowledge whereof me thinkes that the necessarie reading of Histories is halfe lame, and is neither so pleasant, nor so profitable as otherwise it woulde be,) I thought good to write this litle Treatise: in reading wherof, if you reape any profit thereby, I pray you be thankfull to the Right Worshipfull, & my special good friend M. Frances VVindam, *one of the Iudges of her Maesties Court of Common* Pleas, *who first motioned me thereunto, and by whose perswasion I haue the more willingly put the same in* Print.

Vale.

Certaine

Certaine Termes of Cosmographie, *briefly expounded, for those that are not* learned in that Science, to the intent they may the better vnderstand this Treatise.

The Axletree of the world.

THe Axletree of the world is a right line, imagined to passe through the Center or midst of the earth, from the one ende of heauen to the other: the vpper end of which Axletree is called the Pole Arctike, that is to say, the Northe Pole: & the nether end, the Pole Antarctike, that is, the South Pole: vpon which two Poles, otherwise called the hookes or hengils of the world, the heauens doe turne rounde about the earth, and this Axletree signifieth also the first Meridian. Moreouer the Cosmographers doe deuide the world into diuers parts by certaine Circles, whereof some are called greater, and some lesser.

The poles.

The greater are those which doe deuide the world into two equall parts: whereof there be fiue: that is, the Equnoctiall, the Zodiake, the Meridian, the Horizon, and the two Colures.

The Circle

The Equnoctiall is a great Circle, girding the world in the verie midst betwixt the two Poles, by reason whereof there are 2 Latitudes, the one Northerne, and the other Southerne.

The Equnoctiall

The Northerne Latitude is that space, which is contained betwixt the Equinoctiall and the Northe Pole.

The Northerne Latitude

The Southerne Latitude is that space, which is contained betwixt the Equinoctiall and the South Pole, and either of these

two spaces containeth in breadth 90. degrees.

A degree is one part of a Circle, being deuided into 360. parts called degrees.

Againe, the circuit of the Equinoctial, containing 360. degrees, is the very Longitude of the earth: the first degree of which Longitude beginneth at the first Meridian, placed in the West, and so proceedeth Eastward vnto the 180. degree of the Equinoctial, and from thence returneth by the West vntill you come againe to the 360. degree, which is the last degree of Longitude. And note by the way that euery degree of the Equinoctiall containeth 60. English miles, so as the Longitude of the whole earth is 21600. miles.

The Zodiake is a great, broade, and slope, or shoring Circle, carrying the 12. signes: in the middest whereof is a line called the Eclipticke line from which the Sunne neuer swarueth.

The Meridian is a great Circle, passing ouer our heades, in what part of the world so euer we bee, and also through both the Poles: which line when the Sunne toucheth it aboue the Horizon, it is noonetide or midday to those that dwell vnder the same.

The Horizon is a great Circle, deuiding the vpper halfe of the world which we see, from the nether halfe which we see not: in the very middest or Center of which Circle, if in a plaine fielde you looke round about you, you shall alwaies find your selfe to be.

Now as touching the two Colures, because they differ not in effect, though in name, from two Meridians, I leaue to speake of them. aswell for that I haue spoken of thē at large in my Spheare as also for that they are not mentioned in this Treatise.

Of the lesser Circles therebe foure: that is, the two Polar circles, and the two Tropikes. Of the two polar Circles, the one enuironeth the North pole, and therefore is called the Circle Articke, and the other enuironeth the South Pole, and is called the Circle Antarticke, because it is opposite to the other.

Againe, of the two Tropiques, the one is placed betwixt the Equinoctiall and the Circle Articke, and is called the Tropike of Cancer, and the other is placed betwixt the Equinoctiall and the Circle Antarticke, and is called the Tropike of Capricorne: and each of these Tropikes is distant from the Equinoctiall 23. degrees

grees and a halfe, which is the greatest declination of the Sunne from the Equinoctiall, for hee neuer mounteth higher then the Tropique of Cancer, nor descendeth lower then the Tropike of Capricorne, and these two Circles are Parallels to the Equinoctiall.

Parallels are two lines or Circles, equally distant in all places one from another. And by these foure lesser Circles the earth is deuided into fiue Zones or broade spaces, whereof there be two cold, two temperate, and one hotte, described both in my Spheare and also in this Treatise.

A Parallel of the longest day, is a space of the Earth, wherein the day increaseth by one quarter of an houre, proceeding from the Equinoctiall towards any of the Poles:

A Clime is a space of the earth, containing two such Parallels wherein the day increaseth by halfe an houre, of which Climes according to the olde writers, there be seuen declared at the full in my Spheare, and also somewhat touched in this Treatise.

A BRIEFE DES-
cription of vniuerſall Mappes and *Cardes, and of their vſe, and alſo* the vſe of Ptolomey his Tables.



THis word Mappa in Latine ſignifieth a Tablecloath of lynnen to couer a boarde: of the ſhape and likeneſſe whereof vniuerſall Tables, containing the deſcription of the earth, are commonly called Mappes. And firſt you haue to vnderſtand, that euery ſuch Map is chiefly traced with two ſorts of lines or Circles, that is Meridians and parallels. The Meridians are either right or circular lines paſſing through both the Poles of the world, and are imagined to be drawne right vp and downe from the head to the foote of the Map, and are called Meridians, of this Latine word Meridies, which is as much to ſay as midday or noontide. Becauſe that when the Sunne commeth to touch any of thoſe lines, it is midday to thoſe that dwell right vnder the ſame. Againe, parallels are either right or circular lines imagined to be equally diſtant one from another which doe croſſe the foreſaid Meridians with right angles. Now in the verie midſt of the Map is moſt commonly drawne from head to foote a right

line

line which ſignifieth not onely the firſt Meridian, but alſo the Axletré of the worlde, the vpper end of which line is called the Pole Artique, that is to ſay, the Northe Pole, and the neather end, the pole Antartique, that is the South pole, and this line is croſſed in the very midſt betwixt the two poles with another great Circle or right line called the Equinoctiall, becauſe that when the Sunne commeth to touch this line or Circle the day and night is equall throghout the worlde. The one halfe of which line toward the right hand ſheweth the Eaſt part: and the other halfe towards the left hand ſheweth the Weſt part of the worlde: ſo as theſe two lines, the firſt Meridian and the Equinoctiall doe point out the 4. quarters of the worlde, North, South, Eaſt, and Weſt, from whence the 4. principall winds doe blow, betwixt which winds are ſet downe in moſt Maps together with their Latine or Italian names in the outermoſt ſkirt or border thereof 8. other winds, ſo as in all there be 12. winds, whereby the ancient Greekes, and Romans were wont to ſayle. The names whereof both Greeke, Latine and Engliſh are heretofore ſet downe in the later end of my Spheare.

But now to returne to our firſt two lines, that is, the firſt Meridian and the Equinoctiall, you haue to note that both theſe lines or Circles are diuided each of them into 360. degrees, ſo as euery quarter of them containeth 90. degrees. And in the Equinoctiall are ſet downe the degrees of Longitude, which is the length of the worlde, round about from weſt to Eaſt, and againe from Eaſt by Weſt home againe: The firſt degrée whereof beginneth, whereas the firſt aforeſaid Meridian croſſeth the Equinoctiall in the very midſt of the Map, & ſo proceedeth Eaſtward vnto the number of 180. degrees, which is as farre as you can goe Eaſtward, ſith from thence by reaſon of the roundnes of the Earth, you muſt needs turne backe againe Weſtward vntill you come to the 360. degree, which is the laſt degree of longitude, and endeth where the firſt degree beginneth.

Moreouer in the ſaide firſt Meridian, or in ſome other Meridian hard by it, are ſet downe the degrées of Latitude, that is to ſay, the breadth of the worlde both Northerne and Southerne: for from the Equinoctiall to the Northe Pole are contained in the foreſaide Meridian 90. degrees, and that is called the Northe Latitude, and

from

from the Equinoctiall to the South Pole, are contained in the ſaid Meridian, other 90. degrées, which is called the South latitude: and in moſt Maps the Equinoctiall line is diuided & croſſed with 18. Meridians on each ſide of the firſt Meridian, deuiding the Equinoctiall into 36 ſeuerall ſpaces or diſtances, euery ſpace containing 10 degrees, and euery degree containeth 60 Italian miles of length.

Moreouer, betwixt the Equinoctiall and each of the Poles are drawne certaine circles or lines, called (as I ſaid before) Paralels: of which moſt commonly 4. are painted with red inke, ſignifying the 4. leſſer Circles before deſcribed in my Sphere, whereof the higheſt towardes the North Pole, is called a Circle Artique, being diſtant from the Pole 23. degrees and a halfe, & the loweſt towards the South Pole is called the Circle Antarctique being alſo diſtant from the Pole 23. degrées and a halfe: or rather 23: degrées 2″8. for that is the greateſt declynation of the ſunne at this preſent.

Now as touching the other two red Circles, the one lying betwixt the Circle Artique and the Equinoctiall, is called the Tropique of Cancer, and the other lying betwixt the Equinoctiall and the Circle Antartique, is called the Tropique of Capricorne, and each of theſe two Tropiques is diſtant from the Equinoctiall 23. degrees and 2′8. which is the greateſt declination of the Sun, for betwixt theſe two Tropiques the Sunne continually maketh his courſe and returne, as this word Tropique ſignifieth, mounting neuer higher then the Tropique of Cancer: not deſcending lower then the Tropique of Capricorne: for which cauſe ſome doe ſet downe in their Maps betwixt the ſaide two Tropiques an ouerthwart line, ſignifying the Ecliptique line, vnder which the Sun continually walketh. Now by helpe of the foreſaid foure Circles the earth is deuided into 5 Zones, that is, one hotte, 2. Temperate, and 2. cold. The hotte is contained betwixt the 2. Tropiques, in the midſt of which hotte Zone, is the Equinoctiall line, and of the 2. temperate Zones, the one lieth betwixt the Tropique of Cancer and the Circle Artique, and the other betwixt the Tropique of Capricorne and the Circle Antartique.

Againe, of the 2. colde Zones, the one lyeth betwixt the North Pole and the Circle Artique, and the other betwixt the South Pole, and the Circle Antartique, Nowe beſides theſe foure

ſpeciall Parallels there be diuers other Parallels drawne on each ſide of the Equinoctiall, both Northward and Southward, which croſſing in certaine points the firſt Meridian marked with degrees, doe ſhew the true Latitude of euery place, and vnder what Clime or Parallel it is, and alſo how many houres the longeſt day of any place vnder euery Parallel is, beginning to accompte the ſame, either from the Equinoctiall vpward towards the north pole, alongſt the firſt Meridian marked with degrees of Northern Latitude, or elſe from the ſaide Equinoctiall downward towards the South pole, marked with degrees of Southerne Latitude.

Notwithſtanding, they vſe moſt commonly to ſet downe the number and iuſt diſtances of the Climes, Parallels, and houres in the North latitude onely, willing the like numbers of Climes, Parallels, and howers to be accompted in the South Latitude, euen as they are in the North Latitude and with like diſtances. And note that in proceeding towardes the pole from the Parallel, whereas the longeſt day is 24. houres, they accompte the Parallel of the longeſt day no longer by houres, but by monethes, that is to ſay, from one moneth to fiue monethes, whereof wee haue ſpoken before in our Spheare. The numbers of the foreſaid Climes, Parallels and houres you ſhall finde ſet forth in Vopellius Map alongſt the firſt Meridian on the left hand. But hee ſetteth downe the numbers of the longeſt dayes increaſing by months in the vttermoſt border of his Map on the right hand betwixt the North pole, and the Circle Arctique. And in that border he ſetteth downe the number of leagues and miles anſwerable to euery Parallel, whereas alſo he ſheweth the three differences of Inhabitants according to their ſhadowes, that is to ſay, the Periſcii, Heteroſcii, and Amphiſcii.

lius
ppes.

Periſcii are thoſe that dwell in any of the two colde Zones, whoſe ſhadow goeth round about them.

Heteroſcii bee thoſe that dwell in any of the two temperate Zones whoſe ſhadow tendeth at noontide but one way, that is either North or South.

Amphiſcii be thoſe that inhabite the hotte Zone, whoſe ſhadow tendeth both waies, that is ſometime North and ſometime South, as is before declared at large in my Spheare.

But

But in the Map of Gemma Friſius you ſhall find all theſe things ſet forth on the left hand of his Map amongſt the vtter-moſt Circles, whereas vpon the Circle Arctique, he ſetteth downe the twelue ſinges, hauing certaine compaſſes lines, running downe to the Equinoctial, meeting and concurring al in one point at the end wherof vpon the Equinoctiall, you ſhall find the number of houres, at which the Sunne riſeth in euery degrée of Latitude. The M of Ger Friſius

Alſo at the nether end of his Map on the left hand, he placeth a halfe quadrant, which he calleth Directorium nauticum, wherof we ſhall ſpeake hereafter.

And becauſe he would haue his Map to ſerue both ſea and land he ſetteth downe a certaine number of Mariners Compaſſes deuided with 32. lines ſignifying the 32. windes, which doe ſhew how euery place beareth one from the other, and by what winde a Shippe is to be directed from one part to another, wich thing is alſo obſerued in Mercators Map and others that haue written more lately, and yet nothing ſeruiceable for the Sea, becauſe (as W. Borough, Controller of her Maieſties Nauie, a man moſt ſkilfull in the Arte of ſayling ſaith) no conſideration is had in the ſaide Maps or Cardes touching the variation of the Compaſſe, without the which they can neuer ſet downe any true or iuſt direction.

Now as touching the diuiſion and order of the partes of the Earth, moſt commonly deſcribed in vniuerſall Maps, you ſhall vnderſtand that the auncient Coſmographers, not knowing then the Weſt Indies, nor many other places ſituated both Northward and Southward (which haue beene ſince diſcouered) deuided the whole Earth onely into three partes, that is, Europe Aphrike and Aſia, in the deſcription whereof, their Mappes neuer extended in Latitude Northwardes further then to 63. degrees, as I haue ſaid before in my Spheare, and Southward no further then to 16. degrees of Southerne Latitude, or there about, but in Longitude from Weſt to Eaſt, beginning the ſame at the Ilands called Inſulæ Canariæ or Fortunatæ, which are ſituated at the Weſt end of Aphrike, in the Sea called Mare Atlanticum their deſcriptions doe extend to 180. degrees But becauſe a whole

woꝛld almoſt hath beene found out ſince thoſe times, our moderne Coſmographers do deuide the whole earth into foure parts: that is Europe. Aphrike, Aſia and America, which we now cal the Weſt Indies. And becauſe men of diuers Nations haue ſayled round about the woꝛld, Eaſt and Weſt, their late deſcriptions do ertend in Longitude the whole content of the Equinoctiall, which is 360. degrees: and in Latitude Noꝛthwardes, the ſame deſcriptions doe ertend to 80. degrees: and Southwards, to 66. $\frac{1}{2}$ as you may ſee in the vniuerſall Mappes lately ſet fooꝛth by Mercator, and by Barnardus Puteanus and others.

But the ancient and moderne doe greatly differ in the diuiſion of the parts of Latitude, aſwell Noꝛtherne as Southerne, and alſo in Longitude: foꝛ, whereas the ancient Coſmographers doe deuide each Latitude into 90. degrees by certaine Paralels making 9. equall ſpaces, euery ſpace containing 10. equall degrees: in the latter Mappes laſt mentioned, you ſhall finde thoſe ſpaces and the degrees thereof altogether vnequall, the firſt three ſpaces next the Equinoctiall onely excepted, foꝛ thoſe differ not aboue one halfe degree at the moſt: but from thence Noꝛthward, euery ſpace is greater then other, and euery degree in euery ſuch ſpace is greater then other, in ſo much as the fourth ſpace containeth 11. degrees and a halfe of thoſe degrees which are ſet downe in the firſt ſpace, and the fift ſpace containeth of ſuch degrees 13. degrees $\frac{1}{2}$ the 6. ſpace containeth of the ſaid degrees 16 degrees $\frac{1}{4}$ the ſeuenth containeth of the ſame degrees 23. degrees $\frac{1}{2}$ ſoe as that ſpace is twiſe ſo bꝛoad as the firſt ſpace and one halfe degree moꝛe: the eight ſpace containeth of the ſaid firſt degrees 36. further then which 8. ſpaces containing 80. degrees of Latitude, their Mappes ertend not Noꝛthward: and they obſerue the like pꝛoportion in the Southerne Latitude, ſauing that they ertend no farther Southward then to 66. degrees and a halfe.

Againe, they differ in Longitude thus: foꝛ the moderne Coſmographers do make the firſt Meridian to paſſe thꝛough the Iles called Azores, which doe ſtand 5. degrees moꝛe Weſtward then the Fortunate Ilands do: thꝛough which Fortunate Ilands, Ptolomey and his followers doe appoint the firſt Meridian to paſſe.

The cauſe of which tranſpoſing the ſaide firſt Meridian is becauſe that the Mariners Compaſſe doth neuer ſhew the right

Noꝛth

Noꝛth, and South, in any other place, but onely vnder that Meridian. Yea M. Borough thinketh that it would shewe it moꝛe truely, if the saide Meridian were placed somewhat moꝛe Westward. But in those Cardes and Maps that are made accoꝛding to the rules of Ptolomey: the spaces of Parallels containing the 90. degrees of latitude, both Noꝛthward and Southward, are equall, and all the degrees of euery such space, are also equall. And yet the spaces of Parallels that shew the longest day in any place, are toward the Pole, euerie one moꝛe narrow than other: foꝛ as I haue said befoꝛe in my Sphere, there are 3. kinds of paralels that is, Parallels of the Sunne, Parallels of the latitude, and Parallels of the longest day. The causes why in these latter Maps, the degrees of latitude are made greater and greater towardes the Poles, are set downe by Barnardus in his vniuersall Mappe, who saith there that in making the saide Map, he had 3. speciall cares: First, that the places might bee so situated, as they may haue both true direction & distance, & also due longitude and latitude, & as nigh as may be, the same verie shape which they haue in the Spheare oꝛ globe, to which end he hath inuented a newe pꝛopoꝛtion oꝛ habitude of the Meridians to the Paralels, affirming that the Maps befoꝛe made, are not fit foꝛ Nauigation, by reason of the crookednes and bowing of the Meridians, which by the oblique and ouerthwart falling into the Parallels, do so much disfigure in the vttermost parts, the true shape of the Regions, as they can scant be knowne. And as foꝛ the Mariners Cardes, because their Parallels of latitude are also of equall distance from the Equinoctiall to the verie Pole: he saith that they must needes misfashion the Regions, and make the directions, distances, longitudes, and latitudes to bee vntrue, and thereby cause great eꝛꝛoꝛs. Which to auoide, he maketh the spaces of his Parallels and degrees of latitude to increase by little and little towardes the Pole, affirming that thereby all places shall haue their true shape and also their true directions, distances, longitudes and latitudes.

His second care was, that the Regions and places might haue their true quantitie & greatnes, and also true distance one from another, wherein he hath taken as he saith, greatest paines whilest

he did conferre the Cardes and Tables of the Caſtillians and Portugales alwell amongſt themſelues, as with diuers other Nauigations both printed and written. His third care was to ſhewe what partes of the worlde were knowne to the ancient men, that the limits and boundes of their Geographie might not bee vnknowen, to the intent they might haue their due honour and praiſe. And hauing ſhewed what places they did in their time deſcribe both Eaſt, Weſt, North, and South, in the end of his ſpeech, hee affirmeth, that the Auncient Coſmographers haue ſet downe in the Eaſt Indies, more places than euer the Portugales haue as yet diſcouered or attayned vnto.

This Barnardus Puteanus borne in Bruges, is by his owne confeſſion a Cutter or Grauer in braſſe, and alſo a Coſmographer whoſe Mappe ſet foorth in the yeare of our Lord 1579. doeth not differ in any one pointe that I can finde from the laſt vniuerſall Mappe of Mercator that famous Coſmographer, who as I vnderſtand was himſelfe alſo ſometime a Cutter and Grauer of ſuch Mappes and Globes as Gemma Friſius did cauſe to bee printed in his time, from whome Mercator learned great part of his moſt excellent ſkill in Coſmographie.

Truely when I did firſt behold theſe latter Mappes, and ſawe that the Paralels towardes the Pole were as long as the very Equinoctiall it ſelfe, it ſeemed to mee ſomewhat ſtrange, for then I ſaide, that a Ship in ſayling about the worlde vnder the Paralell of 60. degrees, ſhould by this meanes make as long a voyage as that which ſayleth about the worlde right vnder the Equinoctiall which voyage is twice as long. For this containeth in Longitude 21600 miles, which is the whole compaſſe of the earth, and the other contayneth in longitude 1080 myles, which is iuſt halfe ſo much no more. But after I had taken better aduiſement thereof, I found by meaſuring with my Compaſſe, that one degree of the Meridian next to the 60. degree of latitude, did comprehende two of ſuch degrees, as are ſet downe in the Equinoctiall, and that one degree of the Meridian, croſſing the Parallell that hath 70 degrées of latitude, did comprehend 3. degrees of the Equinoctiall line, and ſo I found the degrees towards the Pole to ware greater and greater, by which degrees I perceiued their meaning was

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to haue the longitude of their paralels to bee meaſured, and not by the degrees of the Equinoctiall. And by that meanes their paralels ſhuld haue each one as nigh as might bee to his due Longitude proportionally, euen as they haue in the Globe.

Moreouer the ſhape, quantities, and diſtances of ſuch countries as haue beene found out of late dayes, muſt needes bee more perfectly ſet forth in theſe Mappes, then in thoſe that haue beene made heretofore, becauſe the true longitudes & latitudes of thoſe places were not ſo well knowne then as they are nowe. Albeit I feare mee that of many places in the Indies, there are as yet but few true longitudes knowne. For it is not ſo eaſie a thing to get the true Longitude of euery place, as the true Latitude thereof And had not the late makers of Mappes béne greatly holpen by the Maps and Cardes of ſuch learned Pilots as haue trauailed thoſe countries, I doubt not, but that they ſhould haue committed as great errours as thoſe that wrote before them. And of one thing I doe aſſure my ſelfe, that in theſe latter Mappes, more places are deſcribed, then euer were knowne or diſcouered: as for example, the North parts of Groyneland Crockeland & America, all which they make Iſlandes, and yet neuer ſayled about them, and ſpecially on the North ſide, as it may be well gathered by the vayne attempting of diuers Nations, to finde out newe waies in the North ſeas, to the Moluccas both by Eaſt and Weſt For beeing a little entered into thoſe ſeas, they are quickly driuen backe, eyther by extreame cold, by great Yces, or by the raging flouds bred of ſnowe, and falling from the mountaines of the next continent, and making in ſome places ſuch wherlepooles in the ſea as if any Ship chance to come nigh them it is ſoone ſwallowed vp.

Neyther doe I thinke, that King Arthur in his time euer ſent (as it is reported) any of his people to inhabite thoſe Iſlandes, K. Ar
beeing places in mine opinion, more meet for Whales and monſtrous fiſhes to dwell in, then for men: and ſpecially for Engliſh men, which are not able to ſuffer the cold Winter at Wardhouſe to which place ſome of our Mariners do ſaile in ſommer ſeaſon euery yeare. And yet Wardhouſe hath ſcant in latitude ſeuenty one degrees, much leſſe then are they able to Winter in thoſe places that haue ſeuentie ſeauen degrees of Latitude, as the North ſide of Groynland and Crockland hath. Moreouer the North

North side of the promontorie. Tabin hath 76. degrees of latitude which place, whatsoeuer Plinie saith thereof in his fourth Booke of Hiſtories, yet I beleeue that no Roman came euer there to deſcribe the Promontory. Neither doe I beleeue that the Frier of Oxford, by vertue of his Art of Magike, euer came ſo nigh the Pole to meaſure with his Aſtrolabe thoſe cold partes togither with the foure floodes, which Mercator and Barnardus doe deſcribe both in the front, and alſo in the nether end of their Maps, vnleſſe he had ſome cold deuill out of the middle Region of the aire to be his guide. And therefore I take them in mine opinion to be meere fables. Truely if any men ſhould diſcouer thoſe parts me thinketh that the people of Finmarke and of Wardhouſe or ſuch like people bordering vpon the North Seas, ſhould beſt doe it, hauing bodies vſed to extreame cold. But then beeing bred in ſo groſſe an aire, their wits perhaps are too groſſe for ſuch a purpoſe.

I remember that William Boorne in his booke called the Regiment of the Sea, ſetteth downe fiue ſundrie wayes to ſaile into Cathay, whereof the firſt way is by the Cape of good hope in the vtermoſt South part of Afrike: The ſecond by the Sea called Mare Magellanicum: The third way is to ſaile betwixt the North part of America and the Iles of Groynland and Crockland: The fourth is by Noua Zemla, whereas Sir Hugh Willoughbie in ſeeking that way was frozen to death. The fift way is to ſayle right vnder the Pole, that is, firſt from South to north, vntill you be right vnder the Pole, and then from North to ſouth alleadging there certaine reaſons to proue the 3 laſt wayes poſſiblie to be as paſſable, as the firſt 2 waies well knowne in theſe daies and vſually haunted.

The ſtrongeſt reaſon that Boorne vſeth to make the foreſaide Seas Nauigable, is, for that the Sunne by his long tarrying aboue the Horizon, ſo warmeth both land and ſea, as it cannot bee euer ſoone cold againe. But I pray you what heate can the ſunne yeeld to that place aboue whoſe horizon he is neuer eleuated more then 23. degrees and a halfe, a very cold winterly heat God wot. And though the cold were not ſo extreame as I take it to bee indeed, yet in deſert places, where is there any ſafe harbour, freſh-

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water or any other neceſſarie ſuccor to be had. For in taking ſuch a iournie, let no man thinke to goe through without a bait, vnles he ſaile in Pegaſus, and hath both winde and tide at will.

Notwithſtanding, I can greatly commend thoſe valiant mindes that doe attempt ſuch deſperate voyages, and the rather when they doe it for knowledge ſake, and to profit their countrie, and not altogether for priuate gaine and lucre.

But truely for mine owne part. I thinke it vnpoſſible that any man bred in anye of the temperate zones or in the hotte zone is euer able to continue the whole iournie in any of thoſe 3. waies no, though they were much more paſſable then I take them to be indeed. But if they were paſſible in al reſpects, ſauing for cold, then I thinke no nation or people ſo meete to attempt thoſe waies as thoſe which I haue alreadie named, or ſuch like, borne and bred nigh vnto the north ſeas. But leauing theſe matters, let vs now ſhew how euery one of the 4. foreſaide partes of the Earth that is, Europe, Afrike, Aſia, & America, is bounded, & how many miles each part containeth aſwell in longitude as in latitude, according to ſuch longitude, & latitude as Mercator & Puteanus doe ſet downe in their Maps.

Europe is bounded on the North with the North Ocean Sea, and on the South with the Sea called Mare Mediterraneum, on the Eaſt with the flood Tanais, and on the Weſt with the weſt Ocean Sea. Europe in meaſuring with a right line from the furtheſt part of Ireland on the Weſt vnto the flood Tanais, on the Eaſt both places hauing 52. degrees of latitude, hath in longitude 2166. miles, and in meaſuring with a right line from the furtheſt part of Morea on the South, whoſe latitude is 35. degrees vnto the North Sea ſide hauing 72. degrees of latitude, hath in latitude 2220. miles. Afrike is bounded on the north with the ſtraight ſea Gibalter & with the ſea called Mare Mediterraneum & on the ſouth with a ſea which diuideth Afrike frō the ſouth land not yet fully knowne, & on the Eaſt with the red ſea or gulfe of Arabia, and on the weſt with the great Ocean Atlantique. Afrik in meaſuring with a right line from Gambra on the weſt vnto the Cape de Gardaſa one the Eaſt, both places hauing 10. degrees of North latitude, or there about, hath in longitude 4425 miles. And meaſuring with a right line from the 50. degree of the Equinoctiall vnto the Sea called Mare mediterraneum, it hath in

North Latitude 32. degrees, which being multiplyed by 60. maketh 1920. miles. In South Latitude measuring with a right line, from the 50. degree of the Equinoctiall vnto the Cape of good hope, called in Italian Capo di buona speranza, and in Latine Capud bonæ spei, it hath 35. degrees, which being multiplyed by 60. maketh 2100. miles, which maketh the whole Latitude of Africa to be 4020. miles.

Asia is bounded on the North, with the North Ocean sea, and on the South partly with the red sea, which sea according to Pomponius Mela, extendeth to the Isle sometime called Taprobana now Sumatra: which is a famous market place of all manner of spices. Also Asia is bounded on the South with diuers other gulphes and seas, as you may see in the Map: Againe on the East it is bounded with the East Indian Ocean, and with the straight sea of Anian, and on the West, it hath the flood Tanais & the Fenne of Meotis, and diuers seas, as Bosphorus Cimmerius the Sea called Mare Euxinum, the sea Bosphorus Thracius and Propontis, and part of the sea Mediterraneum, and part of the red sea or gulfe of Arabia, which diuideth Affrike from Arabia Felix. Asia in measuring with a right line from the mouth of the flood Tanais to the promontorie Tamos, both places hauing 50. degrees of Latitude, hath in Longitude 4284. miles, and in measuring with a right line from the 150. degree of the Equinoctiall vnto the promontorie Tabin, Asia hath in North Latitude 75. degrees, which being multiplyed by 60. maketh 4500. miles.

America is bounded on the North, with the North Ocean sea and on the South, with the sea called Mare Magellanicum, on the East with the great Ocean Atlantique, and on the west with the West Indian Ocean, and the strait Sea of Anian: America in measuring with a right line from the straight of Anian to the furthest part of Estotiland vpon the 64. degree of Latitude, hath in Longitude 164. degrees which maketh 4264 miles, and in measuring with a right line from the 270. degree of the Equinoctiall vnto the North sea, it hath in North Latitude 76. degrees, which maketh 4560. miles, and yet the quantitie of the ground described in the Map, is not so great as the other by a seauenth parte: wherein I can very well excuse the Mappe-makers, not hauing perhaps

perhaps as yet the true Longitude of that part of America.

Finally, in measuring with a right line from the 395. degree of the Equinoctiall vnto the sea called Mare Magellanicum, it hath in South Latitude 53. degrees 30. which maketh 3210. miles.

Now if you would know what kingdomes, Regions, Citties, Mountaines, Floods, Lakes, also what seas together with their Ilands, Ports, Capes, Points, and baies doe belong to euery one of the foresaide foure parts, then studie well these moderne Maps: and with your eye you shall beholde, not onely the whole world at one view, but also euery particular place contained therein. Which to describe at the full, in writing would require a long time, wherefore leauing that to your owne industrie, I will shew you how to finde out the Longitude and Latitude of any place in the Mappe.

How to find out the Longitude and Latitude of any place contained in the Mappe.

Also to know how one place lieth from another, and with what wind you haue to saile from one place to another. And finally how to finde out the true distance betwixt place and place, in which things the chiefe vse of Mappes doth consist.

And first you haue to vnderstande, that the Meridians which you see in the Map, doe serue for diuerse purposes. For you learne thereby that it is noone-tide or midday sooner to one place then to another, by marking what Meridian is more towards the East, which the Sun alwaies toucheth sooner then that Meridian which is more towards the west. Also by the Meridians you know how the Eclipse of the Moone appeareth sooner to one place then to an other and with what varietie of time.

For they whose Meridian is towards the West, doe see the Eclipse of the Moone sooner then they whose Meridian is more towards the East, whereas in very truth the Eclipse of the moone is seene to all places (where it can be seene) at one very instant of like greatnesse, and yet semeth to be séene later or sooner, by reasō of the diuersitie of the time of the day, in places standing one East or West from another. And if the distance betwixt those two Meridians doe containe 15. degrees of the Equinoctiall, then the Eclipse appeareth to bee sooner to the one then to the other by one whole howre. For euery 15. degrees maketh an houre, and therefore looke how many 15. degrees you finde betwixt the two Meri-

dians, so many howers are to be accounted. And if you find fewer degrees then the time of the Eclips is to be shortned accordingly, and by attributing 4. minutes of an houre to one degree, (for foure times 15. maketh 60. minutes, which is also one houre) you may make your account so small or great as you will. And note also that you may conceiue to be in the map as many Meridians as there are degrees in the Equinoctiall.

As for the Eclipse of the Sunne, it is seene neither generally, nor fully at one selfe same time, nor yet of the same greatnes in all places. Indeede it appeareth sooner to the Westerne Countries, then to the Easterne. But the diuersitie of the time of appearance doth depend not onely of the number of Meridians, betwixt the two places, but also of the swift or slow motion of the Moone which comming betwixt vs and the Sunne, taketh the sight of the Sun from vs.

Moreouer by the Meridians you shall know what longitude any place in the Map hath by doing thus. First set the one foot of your compasse in the place it selfe, and the other in some Meridian that is next vnto it whether it bee on the left or right hand, it maketh no matter: and from thence draw downe your compasse following still that Meridian vntill you come to the Equinoctiall line, and there marke vpon what degree of the Equinoctiall that foot of your compasse which you did first put in the place, doth rest and there make a pricke. That done, count how many degrees that is distant from the first Meridian, and that is the true longitude of the place: and that longitude serueth to all the places that be vnder that Meridian, though they be neuer so far distant one frō another North and South.

Now if you would know the latitude of any place in the Map that is to say, how farre it is distant from the Equinoctiall either Northward or Southward, either of which latitudes containeth 90. degrees, then do thus: set the one foot of your compasse vpon the very place, and the other vpon that parallell which is next it, whether the parallel bee aboue it or beneath, it maketh no matter, and draw your compasse from that place, following still that Parallel vntill you come to that Meridian which is marked with the degrees of Latitude, which Meridian in the latter Mappes,

standeth

ſtandeth ſomwhat more weſt then the firſt Meridian doth. And marke vpon what degree that foote of your Compaſſe which you did draw from the place doth reſt, and there make a pricke. That done, count how manie degrees that pricke is diſtant from the Equinoctiall, and that is the true latitude of that place. And the like latitude haue all they that dwell vnder that Parallel, howe farre ſo euer they dwell aſunder, Eaſt and Weſt. And by knowing the latitude of any place, you may quickly finde alſo in ſome Mappes vnder what clime or Parallel ſuch place is ſituated and of how manie houres the longeſt day is there, as in the Mappe of Vopellius, of Gemma Frizius and diuers others. But in theſe latter Mappes ſuch thinges are not ſet foorth, wherefore not hauing the other Mappes, you may reſort to the Tables ſet downe in my Spheare, which doe ſhew all ſuch thinges at the full.

Now to know how one place beareth from another, and with what wind a ſhip is to be directed from one port vnto another, and alſo what diſtance is betwixt 2. places, that is, how many miles one place is diſtant from another, the latter Coſmographers, as Mercator, Barnardus, Puteanus, and diuers others haue inuented a new inſtrument called Organum directorium, which they ſet downe in their Mappes together with the vſe thereof. But in mine opinion not plainely enough for moſt mens capacitie. This Inſtrument containeth 2. Quadrants of a Cirkle, hauing the names of the windes written therein: And they call the vpper Quadrant Organum Superius, & the nether Quadrant Organum Inferius. Which two Quadrants haue two lines marked with degrees, and are ioyned together with a right angle, of which two lines the ſtanding or hanging line on the left hand doth ſignifie the firſt Meridian, and is marked with 75. vnequall degrees of latitude, in ſuch proportion as the middle Meridian of the Map hath. The other line which lieth ouerthwart, ſignifieth the Equinoctiall, and is marked with 90. equall degrees of longitude. But the ſpaces of the Parallels of latitude are in number 7. and a halfe, euery whole ſpace containing 10. degrees: and the hale ſpace but fiue degrees, Which ſpaces are wider and wider towardes the Pole, and of like proportion to thoſe of the Mappe.

Organum directorium with the deſcription & vſe the

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And note by the way that the highest right line that goeth from the first Meridian towards your right hand, is the East line, and the nethermost line signifying the Equinoctiall is the West line. For the vpper Quadrant commeth towardes you from East to South, and the nether Quadrant goeth from you towardes the left hand from West to South, and in the Center of each Quadrant muſt bee put a long thread to ſhewe the direction from place to place. The vſe of this Inſtrument is thus: firſt hauing found out in the Mappe the ſeuerall Longitudes, and Latitudes of two places in ſuch order as is before taught, ſeeke the Latitude of the firſt place in the firſt Meridian, and there make a marke. I call here the firſt place, that from whence you goe, and the ſecond that to which you goe. That done, ſeeke out in the ſaide Meridian the Latitude of the ſecond place, and there make another marke. And from that marke of the ſecond place drawe a right line towardes your right hand, ſo as it may bee a Parallel to the Equinoctiall line. Then take the difference of the two Longitudes by ſubtracting the leſſer out of the greater, and ſeeke out the degrees of that difference in the Equinoctiall line, and there make a marke, from which marke draw a right line that may bee a Parallel to the firſt Meridian. And whereas this line croſſeth the firſt line, there ſet downe a marke, then draw a right line from the marke of the firſt place, ſo as it may paſſe through the croſſing point. That done, if the Latitude of the firſt place be greater then that of the ſecond place, make a Parallel to that line with the threade of the vpper Quadrant, but if the Latitude of the firſt be leſſer then the ſecond, then make a Parallel vnto the ſaide line with the thread of the nether Quadrant, which with the helpe of your Compaſſe you ſhall eaſily doe. And that threade being ſtreatched out amongſt the winds, will ſhew by what winde the ſecond place beareth from the firſt. And the oppoſite winde is the director whereby you haue to ſaile: yet neither Mercator nor Barnardus doe plainely ſhew how to find out the true diſtance of two places by this inſtrument, nor yet doe ſet downe in their Mappes, either ſkale or tronke to take the diſtance betwixt two places with the Compaſſe, as moſt comonly all other Maps and Mariners Cardes haue, but doe referre the plaine declaration thereof to other bookes & Ta-

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bles which I haue not yet seene, and therefore in the meane time I thought good to set downe according to Barnardes rule, this briefe way of finding out the distance of any two places whatsoeuer is set downe in their Maps. First with your Compasse, take the iust distance of the two Latitudes vpon the first Meridian which is otherwise called the difference of the Latitude. And hauing laide a ruler or thread to the places, looke how many times the foresaide distance, or difference taken with your Compasse, is comprehended in the space that lyeth betwixt the two places, and by so many times multiply the said difference, the product whereof being multiplyed againe by 60. will shewe howe many miles the one place is distant from the other. As for example, the distance or difference betwixt the two Latitudes of London and Hierusalem, is 19. degrées or there abouts, which being taken with your compasse you find to be two times contained in the space betwixt Hierusalem and London. Wherefore in multiplying 19. degr. by 2. you finde the product to bee 38. which being multiplyed by 60. maketh 2280. miles, and so farre is Hierusalem from London by a right line. But if in measuring the distance betwixt two places with your Compasse there remaine any od space not fully answereing the first wideneſſe of your Compasse, then take that odde space with your Compasse being straightened and made fit thereunto, and looke how many degrees the saide odde space comprehendeth in the first Meridian, about the midst of the degrees of the foresaide difference of Latitude, and adde those degrees also to the rest which you haue alreadie measured and multiplyed, and by multiplying the whole summe by 60. you shall haue the true distance.

Againe, it may bee that the two places doe not differ at all in Latitude but onely in longitude, for as I haue said in my Spheare, two places may differ three manner of waies, that is in Latitude onely, in longitude onely, or in both. And there I doe shewe how euery one is to be measured.

But because that order of measuring is some what busie to such as are not very well exercised in Arithmetike, and doe not know the vse of that tables of Sines called in Latine Tabulæ Sinuum, I thought good to set downe here a more easie way of measuring

ſuring, though perhaps not altogether ſo iuſtlie, and yet without any greate errour. Wherefore if the two places doe differ both in longitude & latitude, then yow muſt doe as before is taught: But if they differ onely in latitude, then you haue no more to doe but to multiplie the difference of the two latitudes by 60. miles, and if there bee any odde minutes, then to allow for euery minute one mile. As for example Compoſtella and Lisbone, two Townes, the one in Spaine, and the other in Portugale haue one ſelfe ſame longitude differing onely in latitude, which difference is 4. degrees, and 20. minutes.

Here if you multiply foure by 60. it amounteth to 240. miles, whereunto by aduing 20. miles for the twentie minutes, you ſhall finde the whole ſumme to be 260. miles, which is the diſtance by a right line betwixt Compoſtella and Lisbona.

But if the two places hauing one ſelfe latitude, doe differ onely in longitude, then looke how many ſuch degrees as are of equall quantitie to the laſt degree of the ſame latitude are contayned betwixt the two places by a right line, and by allowing for euerie degree 60. miles, you ſhall haue the true diſtance, or at the leaſt not much differing from the truth. And if you ſee that the two places in the mappe doe ſtand far a ſunder, then for the more ſpeedines, take with your compaſſe fiue ſuch degrees at once, being firſt pricked vpon a peece of paper which is iuſt 300. miles, and at that wideneſſe meaſure the ſaide ſpace and if there remaine at the leaſt any odd ſpace, then ſtraighten your Compaſſe and fit them to that odde ſpace, and looke how many of the foreſaide degrees that comprehendeth, and hauing multiplied the ſame by ſixtie adde the product therof to the former ſumme.

As for example, Compoſtella and Conſtantinople, hauing one ſelfe ſame latitude, that is, fortie three degrees of North latitude doe differ onely in longitude: Here with my Compaſſe I pricke vppon a peece of paper fiue degrees like in quantitie to the laſt and the vppermoſt degree of the foreſaid forty three degrees, and meaſuring with the wideneſſe of my Compaſſe the ſpace betwixt the two places by a ruler or right line I finde that ſpace to comprehend the foreſaid wideneſſe of my compaſſe 6. times which maketh 1800. miles, & that there remaineth

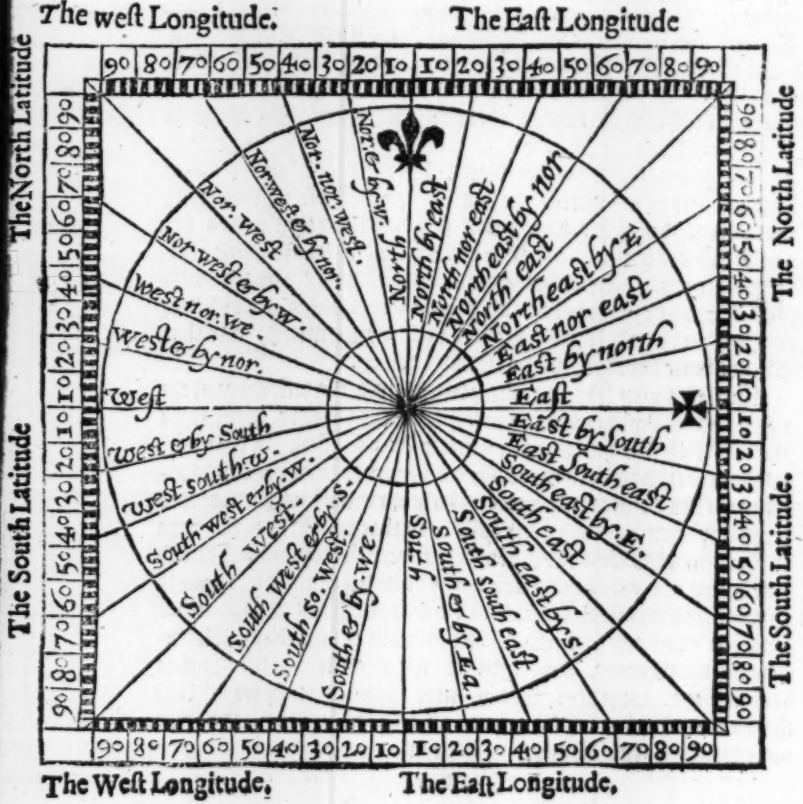
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an odde ſpace containing 3. of the foreſaid degrees, that is, 180. miles, which being added to the former ſumme, maketh in all 1980. miles, which is the diſtance betwixt Compoſtella and Conſtantinople. Alſo if you would knowe the diſtance betwixt two Townes in Africke, the one called Budonell ſtanding vppon Capo viride, and the other called Ercoco, ſtanding hard by the redde Sea, both places hauing one ſelf ſame latitude, that is to ſay, 14. degrees of North latitude, or thereabouts, & doe differ onely in longitude. Then pricke with your Compaſſe vppon a peece of paper 5. degrees, euery one equall to the laſt degree of the foreſaide latitude. And in meaſuring the ſpace betwixt thoſe 2 places with that wideneſſe of your Compaſſe, you ſhall finde the ſame to bee comprehended in the ſaid ſpace 12. times, which by allowing 300. miles to euery wideneſs amounteth to 3600. miles, and the ouerplus of the odde ſpace being 2. degrees, is 120. miles which being added to the former ſumme, maketh in all 3720. miles, and that is the diſtance betwixt Budonell and Ercoco.

And if this way like you not, then multiply the difference of the 2. longitudes, by the miles anſwerable to the latitude of the ſaide places, which you ſhall finde in a ſpeciall table made for that purpoſe, and is ſet downe in my Spheare together with the rule & order that is to be obſerued, therein. The hardeſt of which 2. waies in mine opinion, is much more eaſie than that which is to be done by the former Inſtrument called Organum directorium. Which inſtrument Mercator and Barnardus did borrow as it ſeemeth to me from that which Gemma Friſius calleth his Quadratum Nauticum, inuented by him many yeares ſince: the ſhape, deſcription and vſe whereof, I thought it not a miſſe to ſet downe here and the rather for that in mine opinion it ſheweth both the true courſe and direction to any place more ſpeedily, and with more facilitie then the other.

Here

Here followeth the Mariners *Quadrant*



A DESCRIPTION OF Gemma Frizius his Instrument called Quadratum Nauticum

THis square by two right lines called Diameters crossing one another with right angles in the very Center is diuided into foure equall quarters, and within the saide square vppon the said Center is drawne a Circle, which by meanes of the two foresaide Diameters is also deuided into fourt Quadrants, and euery Quadrant is subdiuided with right lines into 8. partes, so as in all, there bee 32. lines, signifying the 32 winds of the Mariners Compasse. Euery line hauing his proper name of wind written thereon. And note that the right line which is drawne right downe in the middest of the square, signifieth the Meridian, shewing the North point aboue and the South point beneath, and the other right line, crossing the same in the center, signifieth the Equinoctiall line, which sheweth the East point on the right hande, and the West point on the left hand, and the Circle it selfe signifieth the Horizon.

Now you haue to vnderstand, that from the Equinoctiall line vpwardes the 2 sides of the square are diuided each of them into 93 degrees of North latitude, and the other two sides from the Equinoctiall downeward, are likewise deuided on both hands into 90. degrees of South latitude. Then the head or front, and also the base of the said square is deuided in the middest by the foresaid Meridian line into 2. equall partes, whereof the first proceeding from

from the saide Meridian towardes the right hand is diuided as well aboue as beneath into 90. degrees of longitude, and that is called the East longitude, and the other part proceeding from the saide Meridian towards the left hand is likewise deuided as well aboue as beneath into 90. degrees of longitude, and is called the West longitude. The vse of which instrument is thus: First knowing by some Table or Map, the longitude and latitude of two places, take the difference of both by subtracting the lesser out of the greater. And if the longitude of the second place be greater then the first, seeke the difference thereof in the front, and also in the base of the East longitude on the right hand. But if the Longitude of the second place bee lesse then the first, then seeke the difference thereof in the West longitude on the left hande. And heere as before I meane by the first place that from whence you goe, of which two places, the first is alwaies supposed to be in the verie center of the circle, and the other is to be found out thus: first, hauing sought out the degrees of the difference of the longitude, as well in the vpper part, as in the nether part, and marked the same with one pricke aboue, and another beneath, applie your Rular or a thred to those 2. prickes, or els draw a secret right line from the one pricke to the other by a ruler That done seeke out the difference of the two latitudes on both sides of the square, that is to say, if the second place hath greater latitude then the first, then you must seeke the difference in the North latitude, if lesse, then seeke that in the South latitude. And hauing marked the same on both hands, by setting downe on each side a pricke, draw a secret right line from marke to marke, and where the last line crosseth the first line, there make a marke, for there standeth the place whereto you would goe. Which if you would know how it beareth from the first place, then lay your ruler both to the Center and also to that marke, drawing a right line passing through the Center, and also through the saide marke from the one side of the Circle to the other, or els stretch a thread through the Center & the marke, and on that side that the marke is, you shall see the name of the winde that sheweth how the second place beareth from you, the opposite point whereof is the winde whereby you haue to saile. As for example, if you would knowe

how

how Venice beareth from London.

Now if you ſeeke in the Map, you ſhall finde London to haue in longitude 23. degrées and 0. minutes & in latitude 51. degrées and 32. minutes. Againe you ſhall finde Venice to haue in longitude 36. degrees, and 30. minutes, and in latitude 45. degrées & 15. minutes or there abouts.

The difference of the longitude 13. degrees and 30. minutes, which becauſe the longitude of Venice is greater then the longitude of London, you muſt ſeeke it out in the Eaſt longitude on the right hand, and marke the ſame both aboue and beneath. Againe the difference of latitude is 6. degrees and 17. minutes. Which becauſe Venice hath the leſſer latitude ſeeke that out in the South latitude, marking the ſame on both hands. That done, lay two threades, or els draw two right croſſe lines from the foreſaid markes, and where thoſe two threads or lines doe croſſe, make a marke, which marke ſignifieth the place whereunto you would goe which is Venice.

Then from the one ſide of the Circle to the other, lay a ruler, or thread paſſing through the Center, and the ſaide marke made for Venice, at the end of which thread, ruler, or line on the right hand you ſhall ſee the wind which ſheweth how Venice beareth from London, and on the left hand the wind whereby you haue to ſaile, if the ſpace betwixt the two places were all ſea. For in ſayling by ſea, you may not thinke to goe alwaies by a right line, but often to change your courſe according as either mainland, headlands, Iles, Currents, Sands, Rockes, or ſuch like impediments ſhall giue occaſion: and therefore though your right courſe from London to Venice is to goe Southweſt and by Eaſt, yet being come out of the Thames to Douer, your courſe from thence to the Cape of Britaine is Weſt Southweſt. And from thence to the Cape Finis terræ in Spaine, it is Southweſt and by South. And from thence to the cape ſaint Vincent in Portugall you goe right South: & from thence to Gibralter almoſt Eaſt Southeaſt. Againe from Gibralter to the South point of Sardinia, your courſe is almoſt Eaſt and by North. And from thence to the ſouth point of Sicilia almoſt Eaſt Southeaſt: and from thence to Corfu, your courſe is iuſt Northeaſt, and from thence to Venice, you

turne againe Northwest.

Thus you see that in going by Sea, one course doth not hold, no nor yet in going by land, sith Mountaines, Riuers, and Lakes, may put you out of your right course, & yet it is necessary to know how the place whereunto you goe, beareth from you, to the intent that being out of your way, you may alwaies the better direct your course right againe to the same.

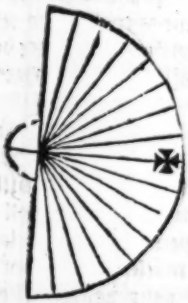
Moreouer, Gemma Frisius saith, that by this Instrument you may also finde out the difference of longitude betwixt the two places from whence and whether you goe, so as you know before how the second place beareth from the first, and also the difference of their latitudes. As for the latitude of each place, you may easily finde the same with your Astrolabe Quadrant, or crosse staffe, by taking therewith the Meridian altitude of the sunne, or the high altitude of some Starre that you know: The order whereof, I haue set downe in my Spheare. And the coast of the Countrie & place whereunto the Shippe is to be directed, is commonly well knowne to the Marriners how it beareth from the first, and speedily hauing a prosperous wind.

Then knowing these two thinges, you must doe thus: First, hauing drawne a secret line or thread, from the difference of the two latitudes, placed according to the rule of greater and lesser, before set downe, and marked on both sides of the Instrument: drawe another thread, or els lay a ruler so as it may passe through the Center, and the line of the winde, or coast whereby the second place beareth from the first. And whereas these two lines or threads doe touch, make a marke, and then lay a Ruler, or extend a thread from the vpper line to the nether line of longitude, so as it may passe hard by the last marke, and then the thread or Ruler so laide, will shewe you the difference of longitude betwixt the two places. And by this meanes Gemma Frisius saith, that the Marriners may easily correct the longitudes of place as they saile: but how truely, I referre that to the skilfull Pilots.

But for mine owne part, hauing to seeke out in these latter mappes the way by Sea or Land to any place, I would vse none other Instrument of direction then halfe a Circle diuided with lines like a Mariners Flie, in such sort as you see in this Figure.

THE

The ſhape of the Flie, the vſe whereof followeth.



THIS Flie containeth two quarters of the Mariners Compaſſe, the middle line whereof marked with a Croſſe, ſignifieth the line which runneth Eaſt and Weſt. For if the place whereto you goe, bee on your right hande, then the Croſſe ſignifieth the Eaſt point, but if it be on your left hande, then turning the Flie towards your left hande, the Croſſe doth ſignifie the Weſt point, and the right downe line Croſſing the forſaid middle line with right angles in the verie Center, is the Meridian line ſhewing the North and South, according as you turne the Croſſe, Eaſt or Weſt.

The vſe, of which Flie is thus: firſt with a pin or a needle being

thrust through the center of the Flie, pricke the pin downe in the verie place from whence you goe, called before the first place, and if the second place be on your right hand, then turne the crosse of your Flie that way, but so as the Meridian of the Flie may bee a true Parallel to the next Meridian of the Mappe that is on your left hand, which your Compasse will quickly performe by taking therewith a iust space at both ends of the Flie betwixt the two foresaide Meridians, that is to say, the Meridian of the Flie, and the next Meridian, of the Carde or Mappe.

That done extend your thread so as it may passe through both the Center of the Flie hard by the pinne and also through the second place, & then looke vppon what winde or coast of the Flie the thread lieth, and that winde sheweth how the second place beareth from you. And the opposite winde thereof sheweth by what winde you haue to saple thether.

But if the second place be on your left hand, then you must turne the crosse of the Flie towards your left hand, and hauing set downe the Center of the Flie in the first place, and with your Compasse made the Meridian of the Flie a iust Paralell to the next Meridian of the Mappe that is on your right hand, lay your thread to the two places as before, and marke vppon what winde of the Flye it striketh, and you shall haue your desire. The lesser that your Flye be, the better, for being great it would couer too many places of the Carde or Mappe. But if the two places stand so nigh together, as the Flie doth couer them both, then hauing set downe your pinne in the first place, make your threade with a noose, and hauing put the same ouer the pin, drawe the thread through the second place somewhat beyond the Compasse of the Flie, and hold it there fast vntill you haue also put the Center of the Flie ouer the said pinne or needle, and duely placed the same in such forme as it is before taught, and in so doing, that line of the Flye which lyeth vpon the thread will shew your course and direction aswell as if the thread lay aboue the Flie.

Truely I doe thinke the vse of this Flie a more easie and speedy way of Direction, then the manifold tracing of the Mappes or Mariners Cardes, with such a number of crosse lines, as commonly are drawne therein, causing rather a confusion then otherwise:

wiſe: for in ſuch Cardes as are made with right Meridians, you ſhall finde the Flie to be much more ſeruiceable then theſe manifold lines:

The vſe of Ptolomies tables.

Thus much touching the vſe of Mappes, and Cardes. Now according to my promiſe, I will briefly ſhew you the vſe of Ptolomies Tables, or of any other table made in that forme. The chiefeſt point whereof is readilie to finde out any place that you ſeeke, and to know where it ſtandeth: For the accomplishment whereof, you muſt firſt knowe what longitude and latitude that place hath.

The longitudes, and latitudes of al places deſcribed by Ptolomie, are ſet downe in his ſecond, third, fourth, fift, ſixt, and ſeuenth booke of Geographie. For in his ſecond booke he deſcribeth the Weſt part of Europe, containing Ireland, England, and Scotland, Hiſpania, Gallia, Germanie, Hungarie, and Slauony. In his third booke he deſcribeth the Eaſt part of Europe, as Italie, Sicilia, Corſica, Sardinia, Sarmatia, Taurica, Peninſula, Datia, Miſia, Thracia, Macedonia, Achaia, Peloponeſus, Candia, Rubia, and diuers other Lands and Iſlands. And hee containeth all Europe in ten Tables. In his fourth booke he deſcribeth Afrike, that is to ſay, ſo much as was knowne in his time, containing the ſame foure Tables. In his fift, ſixt, & ſeuenth booke, he deſcribeth all Aſia and the Eaſt Indians, whereof he maketh 12. tables, and in deſcribing any Region or prouince, hee ſheweth how it is bounded both North and South, Eaſt and Weſt. And alſo what notable Cities, Flouds, Lakes, & Mountaines be in euerie Region, and therewith ſetteth downe the longitude and latitude of euery place: to which his booke, diuers haue made certaine Alphabeticall tables, containing the names of all the places that are mentioned in the foreſaide books, ſhewing in what leafe to finde the ſame: to the intent that you may the more readily finde out, not onely the place, but alſo the longitude and latitude thereof, and in what Table it is contained.

Notwithſtanding, I know by good triall, that there are a number of places mentioned in the ſaid bookes, which you ſhal not find in the foreſaide Alphabet.

Wherefore I wiſh, that Mercator, Ortellius, Barnardus, Brugenſis, or any other of the Coſmographers and ſetters forth of Maps and Cardes, would take the paines to make a generall Alphabet containing all the names that are to bee found and knowne, both auncient and moderne, of Regions, Citties, Seas, Floudes, Lakes, Riuers, Portes, Bayes, Headlandes Capes, Mountaines, and all other notorious places, contained in their Maps and Cards, together with the true longitude and latitude, annexed to euery place, and agreeable to their Maps, to the intent that euerie man delighted with the reading of Hiſtories, may in their Mappes both generall and ſpeciall, eaſily find out any place that hee ſeeketh. Which worke in mine opinion would bee moſt thankefully receyued of al thoſe that delight in Geographie, to the great commendation and prayſe of the Authors thereof.

For though Ptolomy, Appian, Gemma Friſius, Gaſtaldus Orontius, munſterus, Ortellius, and others haue ſet downe certaine names, both auncient and moderne together with their longitudes and latitudes, yet they are but very few in compariſon of all the names that are wanting yea or of thoſe that are comprehended in their owne Cards and Maps, all which Maps I would wiſh to agree in their longitudes and latitudes: for otherwiſe a man ſhall hardly finde the place which hee ſeeketh.

Wherefore I pray God with all my hart, that ſome good man that is a ſkilfull Coſmographer may ſhortly trauell herein, vnto ꝑ profit of all Students in Geographie.

But now to returne to my matter, which is to ſhew how to find out any place contained in Ptolomies tables. I ſay that you muſt firſt finde out the name of the place in the Alphabet, and that will direct you to the booke wherein it is ſet downe, together with the longitude and latitude thereof. And there alſo you ſhall finde in what table it is contained.

Then hauing taken a note of the longitude & latitude, and alſo the number of the table wherein it is to be ſought, reſort to that table, be it in Europe, Affrike, or Aſia. In the front of euerie which

table,

table, & alſo in the baſe or ſet downe certaine numbers of longitudes, in ſuch ſort as the vppermoſt and nethermoſt bee like numbers, and doe directly anſwer one another. Againe, on both ſides of the Table are ſet downe certaine numbers of latitude like in quantitie, and directly anſwering one another.

Then ſeeke out the longitude of the place which you woulde finde in the front and alſo in the baſe, and marke the ſame with two prickes, one aboue and another beneath: From which two prickes, lay a rulet or extend a thread, holding it faſt there vntill you haue found out the latitude of the place on both ſides of the table, which beeing alſo marked on each ſide with a pricke, extend another thread from thoſe two laſt prickes, and in that, berie point whereas the two threads doe croſſe, you ſhall finde the place to be which you ſeeke, or at leaſt ſhould be there. Moreouer, on the right hand of euery Table, Ptolomie ſetteth downe moſt commonly vnder what Clime and Parallel euery place is, & by that meanes you may alſo knowe the longeſt day that any Paralel hath. For as I haue ſaid before in my ſpheare, euery Paralel proceeding from the Equinoctiall towards the Pole, encreaſeth by one quarter of an houre, and euery Clime containing two Paralels, encreaſeth by halfe an houre.

Of which Climes Ptolomie ſetteth downe but ſeuen, but of Paralels hee maketh 21. in ſuch order as this table following ſheweth, which Table conſiſteth of foure Columnes, whereof the firſt containeth the ſeauen Climes together with their names, & alſo how many miles euery Clime hath in breadth. And the ſecond containeth 63. degrees of latitude, further then which Northward, Ptolomie his Tables doe not extend, The third containeth the numbers of the 21. Paralels, and the fourth the houres & minuts of the longeſt day in euery Paralel, as this table here next following ſheweth.

Notwithstanding, I know by good triall, that there are a number of places mentioned in the said bookes, which you shal not find in the foresaide Alphabet.

Wherefore I wish, that Mercator, Ortellius, Barnardus, Brugensis, or any other of the Cosmographers and setters forth of Maps and Cardes, would take the paines to make a generall Alphabet containing all the names that are to bee found and knowne, both auncient and moderne, of Regions, Citties, Seas, Floudes, Lakes, Riuers, Portes, Bayes, Headlandes Capes, Mountaines, and all other notorious places, contained in their Maps and Cards, together with the true longitude and latitude, annexed to euery place, and agreeable to their Maps, to the intent that euerie man delighted with the reading of Histories, may in their Mappes both generall and speciall, easily find out any place that hee seeketh. Which worke in mine opinion would bee most thankefully receyued of al those that delight in Geographie, to the great commendation and prayse of the Authors thereof.

For though Ptolomy, Appian, Gemma Frisius, Gastaldus Orontius, munsterus, Ortellius, and others haue set downe certaine names, both auncient and moderne together with their longitudes and latitudes, yet they are but very few in comparison of all the names that are wanting yea or of those that are comprehended in their owne Cards and Maps, all which Maps I would wish to agree in their longitudes and latitudes: for otherwise a man shall hardly finde the place which hee seeketh.

Wherefore I pray God with all my hart, that some good man that is a skilfull Cosmographer may shortly trauell herein, vnto ꝑ profit of all Students in Geographie.

But now to returne to my matter, which is to shew how to find out any place contained in Ptolomies tables. I say that you must first finde out the name of the place in the Alphabet, and that will direct you to the booke wherein it is set downe, together with the longitude and latitude thereof. And there also you shall finde in what table it is contained.

Then hauing taken a note of the longitude & latitude, and also the number of the table wherein it is to be sought, resort to that table, bee it in Europe, Affrike, or Asia. In the front of euerie which

table,

table, & also in the base or set downe certaine numbers of longitudes, in such sort as the uppermost and nethermost bee like numbers, and doe directly answer one another. Againe, on both sides of the Table are set downe certaine numbers of latitude like in quantitie, and directly answering one another.

Then seeke out the longitude of the place which you woulde finde in the front, and also in the base, and marke the same with two prickes, one aboue and another beneath: From which two prickes, lay a ruler or extend a thread, holding it fast there vntill you haue found out the latitude of the place on both sides of the table, which beeing also marked on each side with a pricke, extend another thread from those two last prickes, and in that, herie point whereas the two threads doe crosse, you shall finde the place to be which you seeke, or at least should be there. Moreouer, on the right hand of euery Table, Ptolomie setteth downe most commonly vnder what Clime and Parallel euery place is, & by that meanes you may also knowe the longest day that any Parallel hath. For as I haue saide before in my speare, euery Parallel proceeding from the Equinoctiall towards the Pole, encreaseth by one quarter of an houre, and euery Clime containing two Parallels, encreaseth by halfe an houre.

Of which Climes Ptolomie setteth downe but seuen, but of Parallels hee maketh 21. In such order as this table following sheweth, which Table consisteth of foure Columnes, whereof the first containeth the seauen Climes together with their names, & also how many miles euery Clime hath in breadth. And the second containeth 63. degrees of latitude, further then which Northward, Ptolomie his Tables doe not extend.

The third containeth the numbers of the 21. Parallels, and the fourth the houres & minuts of the longest day in euery Parallel, as this table here next following sheweth.

The seuen Climes with their names and miles in breadth, which you must count from beneath vpward.	The degrees of Latitude.	The Parales	The houres and minutes of the longest day in euerie parallel. H	M
	63	21		19 30
	60	20		19 0
		19		18 30
		18		18 0
		17		17 30
7 Dia Ripheos. 195.	50	16		17 0
		15		16 30
6 Dia Boristines. 225.		14		16 0
		13		15 30
5 Dia Romes. 270.	40	12		15 0
		11		14 45
4 Dia Rhodou. 330.		10		14 30
	30	9		14 15
Dia Alexandrias. 370.		8		14 0
3		7		13 45
		6		13 30
2 Dia Sienes. 420.		5		13 15
	20	4		13 0
1 Dia Meroes. 465.				
765.		3		12 45
	10			
		2		12 30
		1		12 15

This nether line diuided into degrees, signifieth the Equinoctiall line, vnder which those that dwell haue no Latitude, and therefore they haue alwaies twelue howers day, and twelue howers night.

But you haue to vnderſtand, that whereas Ptolomie maketh the furtheſt Northpart of his ſeuenth Clime called Dia Ripheos to haue but 50. degrees and 30. minutes of latitude, the moderne Coſmographers do allow to thoſe mountaines 70. degrees of latitude, affirming the ſame to be thoſe ſelfe mountaines which are otherwiſe called Montes Hiperborei, which becauſe they encloſe a great part of the Northſide of the worlde, are called Orbis terræ cingulum, that is to ſay, the girdle of the worlde, the wrong latitude whereof and of diuers other, I thinke Ptolomie had from other and not from himſelfe.

For being brought vp in ſo warme a ſoyle as Alexandria ſtandeth in, he could neuer endure to goe ſo farre Northward, to take the latitude of thoſe cold Riphean Mountaines, and therefore if you liſt to know what latitude doth truely belong vnto euerie Clime and Paralell, then reſort to Orontius his Table of Climes and Parallels, ſet downe in my Spheare, which ſheweth how many degrees of latitude euery Paralel hath, together with the longeſt day, euen from the Equinoctiall to the verie Pole: wherfore I leaue to ſpeake here any further thereof, and ſo for this time ends this Treatiſe.

Now here followeth the order of making Ptolomie his Tables and of all other Maps, both vniuerſall and particular.

THE TRVE ORder of making of ptolomie his tables, and also the making of all *other tables Maps, or Cardes, as well* vniuersall as particular, and that according to the doctrine of the best Geographers, that be or haue beene in these latter dayes.

PLAINELIE SET FORTH IN OVR NAtiue speech, by *Maister Blundeuile* in the yeare of our Lord. 1597.



AT LONDON
Printed by John Windet.

How to describe in manner of a Table, like vnto the tables of Ptolomie any Countrie or Region, and all the places contained therein by knowing their longitudes and latitudes.



For example you woulde describe the Countrie of Fraunce, which containeth in latitude 10. degrees, and in longitude 16. Here first you must drawe a perpendicular line through the midst of your Table or Carde from head to foot signifying the Meridian or Arlettree of the worlde, marked with the letters E F. as you may see in the former Table of Fraunce, and diuide that line into ten equall parts, then drawe two Parallel lines: whereof the one must crosse the said line aboue in the point e. with right angles, and the other Parallel must crosse it againe beneath in the point f. with like angles, and marke the vppermost Parallel with A.B. and the neathermost Parallel with C.D. Then with your Compasse take one of the 10. partes of the sade line e.f. which is one degree, and set that downe by it selfe, deuiding the same into 60. minutes as the short line G.H. set downe on the right hand of the former Table of France doth shew: And hauing learned by some Table or Mappe, that the furthest part of France northward, through which the Parallel A B, passeth is distant from the Equinoctiall 52. degrees, and that the South Parallel C.D. is distant from the Equinoctiall 42. degrees, & also hauing learned by another table, called the Table of miles here following, that to euery degree of the Paralel 42. mar-

marked with A B. doe belong 37. miles, & that to euerie degree of the Parallel marked in C D. belongeth almoſt 45. miles. Take therefore with your Compaſſe from the ſhort line G H. 37. parts or minutes, and keeping your Compaſſe at that wideneſs, diuide the parallel A B. into 16. equall ſpaces, anſwerable to that wideneſſe (that is to ſay) 8. partes on each ſide of the Meridian E F. at which Meridian you muſt begin to meaſure towards eyther hand, both right and left, ſetting downe a pricke at the end of euerie ſuch ſpace. Then for the South Parallel C D. take from the ſhort line G H. 45. parts or minutes, and diuide that Parallel into 16. ſpaces anſwerable to that wideneſſe of the Compaſſe, ſetting downe eight ſuch ſpaces on each ſide of the Meridian E F: beginning to meaſure from the Meridian E F. as before, and ſet downe at the end of euery ſuch ſpace a pricke, then from thoſe prickes, ſo ſet downe in each of the two Paralels A B and C D. draw right lines, from pricke to pricke, and thoſe ſhal bee Meridians, ſhewing as well the longitude of the whole Region, as of euery particular place contained therein.

Then like as the Meridian E F. is diuided into 10. equal parts: ſo diuide againe into the like partes each of the two outermoſt Meridians, as well that on the left hande, as that on the right hand, ſetting downe a pricke at the end of euery ſuch ſpace and from pricke to pricke draw right lines paſſing through all the Meridians, and thoſe ſhall be the Parallels, and in the outermoſt ſpaces write the numbers as well of longitude as of latitude beginning your longitude at the outermoſt Meridian on the left hand, which is the furtheſt Meridian Weſtward as well aboue as beneath.

And becauſe that the furtheſt Meridian Weſtwarde is fourteene degrees diſtant from the Meridian of Inſulæ fortunatæ, which of all the ancient Geographers is counted the firſt Meridian: remember therfore to ſet downe in the firſt ſpace on the left hand aſwell aboue as beneath, Arithmeticall figures. 15. and in the ſecond ſpace 16. and in the third ſpace 17. and ſo proceed from ſpace to ſpace till you come at 30. for betwixt 14. and 30. are contained 16. degrees, ſo haue you the whole longitude of France which is 16. degrees.

Thus

Thus hauing ſet downe the numbers of the degrees of latitude, beginning at each end of the South Parallel CD. and ſo proceede vpwarde alongſt the two outermoſt Meridians, ſetting downe in the firſt ſpace of the verie foote of the Table 43. degrees as well on the one hand, as on the other, and in the ſecond ſpace 44 and in the third ſpace 45. and ſo proceede vpwarde to 52. ſo haue you the whole latitude of France: for betwixt 42. and 52. are contained iuſt ten degrées, and if your Carde be large enough, you may diuide euery ſuch ſpace or degree as well of longitude, as of latitude into ſix partes, euery ſuch part containing ten minutes.

Nowe to place Cities, or Caſtles, Riuers, Mountaines, or ſuch like, you muſt learne the longitude and latitude of the ſame place, eyther by Ptolomies Tables, or by ſome more moderne Table or Mappe, and then ſet them downe in your Carde or table accordingly. As for example, ſuppoſe that you would firſt ſet downe in the ſaid Table the chiefe towne of of France called Paris, whoſe longitude you finde by Ioliuits Card, to be 23. degrées 40' the latitude thereof to bee 48. degrees. Here you muſt ſeeke out the ſaide longitude by extending a thread from the 23. degree of the Parallel A B. to the like degree in the Parallel CD. and there holding it faſt, croſſe that thread with another thread extended from the Meridian A C. to the Meridian B D. in thoſe two points, in which are ſet downe 48. degrees 10. and whereas the two threads doe croſſe, there make a little rounde o. and write thereon Paris, for that is his place, and as you haue ſet downe this Cittie, ſo you may ſet down Orleans, Roane, Lyons, Tolous, as you ſee in the former table of France, and in like order you may ſet downe all other places and cities whatſoeuer.

But when you would deſcribe any Riuer, then you muſt take the longitude and latitude as well of the beginning as of the ending thereof, and alſo the longitude and latitude of their boutes or and out, and to conſider by whattownes ſuch Riuers doe paſſe, & on what ſide, and whether they paſſe through the middeſt of anie Towne or not, and what notable bryeges are built ouer the ſame, and by like meanes you may place in your Carde, Woodes, Forreſts and mountaines, and all other places whatſoeuer.

And

And you haue to note that all great Riuers doe commonly fal eyther into the ſea, or els into ſome great lake, and the ſmall Riuers doe fall into the great riuers:

Now to make a ſcale to your Carde, there is no more to doe but to know the diſtance betwixt any two places, eyther by relation, or by your owne experience, and then to draw three Paralel lines, making two ſpaces one larger and another leſſer in ſome voide ſpace of the Carde of ſuch length as that voide ſpace will giue you leaue, and to diuide the ſaide ſcale into ſo manie miles as the length of the ſaid void ſpace wil ſuffer you, and that accordyng to the quantitie of the miles of diſtance firſt knowne. As for example, you know the diſtance betwixt Paris and Roane to be 30. French leagues, which is of our miles 60. allowing two miles to a French league: wherefore diuide your ſcale into 30. equall partes accordingly, and ſet downe numbers in the larger ſpace thus. 10, 20. 30. and ſo foorth, ſo far as your void ſpace will giue you leaue, and by taking with your Compaſſe the diſtance of any two places ſet downe in the Carde, and applying the ſame to the ſcale, you ſhall know thereby how many miles ſuch diſtance contameth, and to that end the narrow ſpace would be deuided into 10. ſmall and equall parts betokening ſingle miles or leagues, as you ſee here in the ſcale ſet downe vnder the Table of France, and ſee that the knowne diſtance of the two places whereby you make your ſcale, may containe ſuch number of leagues or miles as doe end in an article, as in 10. 20. 30.

But one thing you haue to remember that though in making theſe kindes of Cardes or Tables, you bee willed to drawe right lines from pricke to pricke, aſwell to deſcribe the Meridians as the Parallels, yet ſuch lines would be drawne with blacke lead, ſo as they may be all wiped out, ſauing where as they croſſe one another in the outermoſt ſpaces wherein you haue to ſet downe the degrees and minutes, as well of longitude as of latitude: for otherwiſe thoſe right lines in ſmall Cardes would ſomewhat hinder and diſgrace your worke, neyther ſhould it be like in al points, to thoſe of Ptolomey and of all other moderne Writers deſcribing any Countrie, in like maner: in whoſe tables neyther the Meridians nor the Paralels are to be ſeene, but onely in the outermoſt parts as is before ſaid.

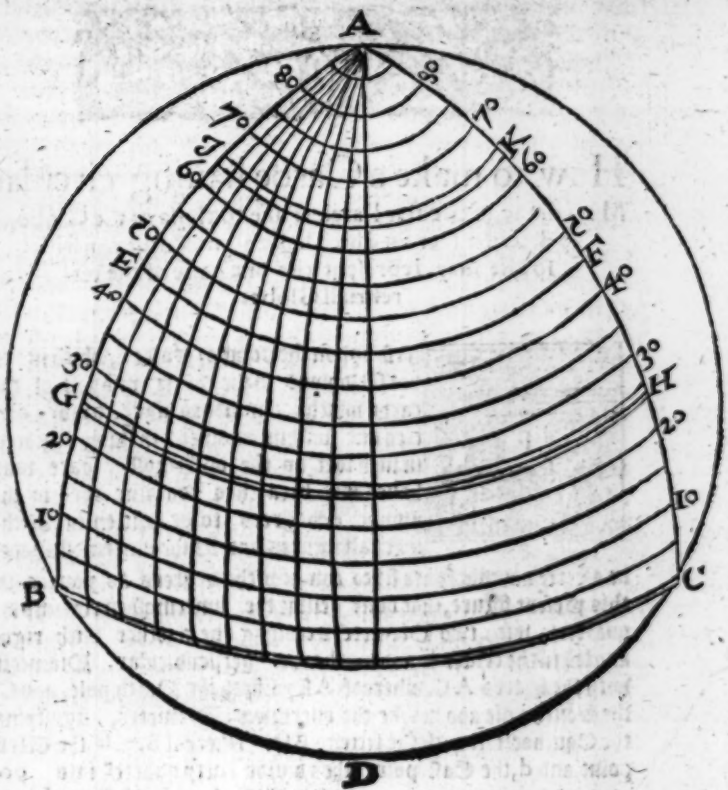
How

How to deſcribe ſome particular region or part of the earth, in ſuch ſort as both the Meridians and the Paralels may be circular lines, and may bee like to the eight part of the conuex ſuperficies of a Globe.

FIrſt drawe a circle of ſome large quantitie, and diuide the ſame into three equall parts marked with the letters A. B. C. and let A. be placed aboue, and B. C. beneath, as you ſee in the figure following. Then putting the firme foot of your Compaſſe in A. extend the other foote to B. or C. and drawe an arch or portion of a circle, which may paſſe through B. C. and keeping your Compaſſe at that widenes, ſet the firme foote in C. and drawe the like arch from B. to A. and thirdly ſet the firme foote in D, and drawe the like arch from A. to C, and ſuppoſe A, to be the North pole, and the arch BC. to be a quadrant or fourth part of the Equinoctiall line, and ſuppoſe AB, and AC. to be the ſides or Meridians of other 2. quadrants: which 2. quadrants, together with the thirde quadrant BC. doe encloſe the 8. part of the conuere ſuperfices of the Globe. That done, diuide the arch BC. into two equall parts, with the right line AD. which line AD. you muſt diuide into 9. equall partes, or into 18. partes, containing in all 90. degrees: ſo ſhall euerie ſpace containe fiue degrees. That done ſet the firme foot of your Compaſſe in the point A, and drawe with the other foote ſo many Paralels as there are points of Diuiſion in the right line AD. making in all 18. Paralels, which Paralels muſt extend to the two outſides AB, and AC. Then diuide the quarter BC. in like manner into 18. equall parts, & alſo deuide the mid del

Parallel marked with letters E F. into 18. equall parts, that done, draw through euery Diuiſion of the quadrant B C, and alſo through the diuiſion of the parallel E F. Meridians anſwerable to the ſame, ſo as they may meet in the pole A. of which Meridians A D, is a right line, and to doe that rightly you muſt finde out a ſeuerall Center for euery one of the ſaid Meridians, which is not eaſily done vnles you haue an Inſtrument meete for the turne, and ſpecially if the Carde be of any greatneſſe, and hauing drawne your meridians, ſet numbers to euery one of the three quadrants, beginning to count the firſt 90. from B. to C. and ſecondly from B. to A. and thirdly from C. to A. that done, count in the Meridian A D. from d, vpward 23. degrees and 28. minutes which in theſe dayes is the greateſt declination of the Sunne, and there hauing made a pricke in the ſame line, put the firme foote of your Compaſſe in the pole A. and extend the other foote to the foreſaid pricke, through which you muſt draw a Parallel from the ſide A B, to the ſide A C. and mark the ſame with the letters G H. for that ſhall be the tropique of Cancer, then with your Compaſſe take the diſtance that is betwixt d. and the foreſaid tropique, and keeping your Compaſſe at that Wideneſs, ſet the firme foote thereof in A. and with the other foote drawe another Parallel marked with the letters i, k, ℓ that ſhall be the circle artique, whoſe diſtance from the Pole is alwaies equall to the greateſt declination of the ſunne, and thus your Carde is readie to deſcribe therein any Region or Countrie, whereof the longitude doth not exceede 90. and that it hath North latitude, as this figure following plainelie ſheweth.




A
80
70
60
50
40
30
20
10
E
G
H
B
C
D

How to make a Carde hauing circular Meridians, & circular Paralels like to thoſe of the Globe, to deſcribe therein which halfe of the world you will, ſo as it may repreſent the one halfe of the terreſtriall Globe.



Firſt vppon the point or centre e, which is to bee ſet downe in the verie middeſt of the carde which you minde to make, draw 3 circles one within another, making 2. ſpaces in ſuch ſort as the outermoſt ſpace may haue ſome breadth to containe therein the number of degrees to be written in Arithmeticall figures, and let the innermoſt ſpace, be a verie narrow ſpace fit to containe the degrees as you ſee in this preſent figure, that done deuide the innermoſt circle into 4. quarters, with two Diameters croſſing one another with right angles in the center E. and marke the perpendicular Diameter with the letters AC. whereof A ſignifieth the North pole, and C. the South pole and marke the ouerthwart Diameter, ſignifying the Equinoctiall with the letters BD. whereof B. is the Weſt point, and d, the Eaſt point, then diuide euery quarter into 90. degrees beginning to account from B to A, and alſo from d to A, vpward, and from B to C, and likewiſe from d. to C. downeward, then applie your ruler to the pole A. and to the fift degree of the innermoſt circle proceeding from B. to C. and whereas your ruler croſſeth the Equinoctiall, there make a pricke vppon the Equinoctiall, and ſo proceede towardes c, from 5. degrees to 5. degrees, and againe from c. to d, in like maner not forgetting to

ſet

set downe prickes vpon the Equinoctiall at euery section, so shal you deuide the Equinoctial into 180. degrees counting frō b, to d, and therefore you must set downe vppon the Equinoctial the numbers of the degrees thus, 10. 20. 30. and so forth, vntill you come to 80. as you see in the former figure. Then by laying the one end of your Ruler to b, and the other end to euery 5 degree of the semicircle a, d, c, deuide, the Meridian a, c, as you did before deuide the Equinoctiall b, d, making prickes or strikes vppon euery section or diuision of the same meridian a, c, and these two lines (that is to say) the Equinoctiall line, and the meridian line being thus deuided, you must draw vpon the two Poles a, c, Geographical paralels, wherof you may draw two by setting the one foot of your compasse in the pole a, and the other foot in the first section of the meridian a, c, that is next vnto a, and képing your compasse at that wideness, you may make the like Paralel vppon the South Pole by setting the one foot in the point c and the other in that section of the said meridian that is next vnto c, but to find out the Centers of all the rest of the Paralels, both Northward and Southward, you must draw out the line a c at both ends so long as you can, for in that line you haue to find out all the Centers, which Centers must be such as the firme foot being set therin, the other foote may passe through euery section of the Meridian line, and also through euery fift degree of the inward circle containing the degrees on both sides of the said meridian, and hauing drawne after this manner the 18. Northern Paralels, you may easily draw the other 18. Southern paralels by marking wel the first centers of the Northern paralels taking the iust distance of euerie one with your Compasses, and by setting downe the same vpon the Meridian line a, c, on the South part thereof.

Now to describe the meridians, you must drawe out the line b, d, at both ends so farre in length as shall suffice, in which line you haue to find out the Center of euery meridian, first of those in the West part, & then of those in the East part, by setting the one foot of your Compasse in the center, and the other foote so as it may passe through euery section of the line b, d, & also through both the poles, and hauing drawne the Westerly 18 Meridians,

you shall easily draw the Easterly Meridians by reducing the selfe same distances of Centers vnto the West part, by help wher of you did drawe the Easterly Meridians or els you may drawe first a West Meridian, and then an East Meridian, whilest the Compasse is at one selfe widenes, and thereby you shall drawe 2 Meridians at one instãt, & you may also obserue the like order in drawing the North & South paralels before mentioned. Thẽ you haue to draw the two tropiques and the two polar circles in manner and forme following: first to draw the tropique of Cancer, set one foot of your Compasse in the Center c, and the other foot in the Meridian or line a.c, at such distance as is the greatest declination of the Sunne, which is 23. degrees, and 28. minutes, and there set downe a pricke or marke. then aswel from d towardes a, as from b, to a, count the said greatest declination of the Sunne, which is 23. degrees, 28. and there make a marke on the innermost of the thre outward Circles on both handes, that done seeke a Center vppon the extended line a, f, so as from thence you may draw a Circle that may passe through the thre markes last mentioned, and that shall be the tropique of Cancer then keeping your Compasse stil at that wideues, transferre the same to the extended line c, g, setting the firme foot, so as you may draw with the other foote another circle that is of like distance from the Equinoctiall, and that shall be the tropique of Capricorne.

Now to draw the polar circles you must do thus. Number vppon the first Meridian A, C, from the pole towards c, the greatest declination of the Sunne, and there make a marke, & againe from the pole vppon the innermost circle on both sides of the Meridian count the like quantitie of degrees, & marke the same quantitie vppon the first Meridian, then hauing found the center in any of the extended lines belõging to the poles, draw a circle through those three markes and the circle drawn towards a, shal bee the circle artique, and the other drawne towards c, with like widnes of your compasse shall be the circle antartique, and so your card is readie to describe therein what places you will, knowing the longitude and latitude therof, and that the longitude doe not exceed above 180 degrees. And I take this forme of Card to be the

best

best both for sea and land: for euery region therin described, must needs haue his true shape, so as you know the true longitude & latitude of the outermost bounds and limits thereof.

Besides these manner of Maps Planctius setteth downe the whole earth in two seuerall rundles, each one containing the iust halfe of the earth that is to say, the Northy halfe and the South halfe making the Equinoctiall in each halfe the outermost circle and the center of the northy rundle signifieth the Northy pole, and the center of the South rundle signifieth the South pole, which manner of Mappe, because I haue alreadie plainely set downe together with the vse thereof in my description of Planctius his vniuersal Map, I leaue to deale any further therewith. I haue seene also many years since an vniuersal map made by a french man, which was round in shape like vnto a planisphere, hauing both the poles placed in the verie Center thereof, which map because I cannot get here in England for any monie, I am forced to leaue vndescribed, and in stead thereof, I think good to set downe here the description of a verie good Map of Europe made by Mercator in the yeare of our Lord 1554 because the manner of making the said Mappe doth greatly please mee.

Maister Blundeuile his description of an excellent good Mappe of Europe, made by Mercator in the yeare of our Lord, 1554. in which description is first shewed the manner of making the saide Map, & thē the vse thereof.

FIrst the said Mercator considered what longitude and latitude Europe hath, & knowing partly by the ancient Tables of Ptolomie, and such others, but chiefly and most truly by the moderne Maps and Sea Cards, that Europe had in longitude no more then 70. degrees, counting from the first meridian passing through the Iles Canarie, otherwise called Insulæ fortunatæ, vnto the Meridian which passeth through the floud Tanais, which is the vttermost bound or limit of Europe towards the East, deuiding the same from Asia, yet because hee thought good to set downe in his Mappe a good part of Asia, wheron Europe abutteth or bordereth towardes the East, he made the said longitude in his Map to extend Eastward 100. degrees euen to the further side of the great floud Obye, and though he found by the aforesaid tables and Sea cardes, that the latitude of Europe was no more but 40. degrees, counting from the paralel of 30. degrees of North latitude, vnto the paralel of 70. degrees of North latitude, yet he maketh his Map to extend farther as wel Northward as Southward, as you may plainely see in beholding the said carde. These things beeing presupposed in the way of preamble I will now shew you what order he obserued in making the said Carde. First, hee drew a right perpendicular line through the middest of his Card, which he calleth the middle meridian

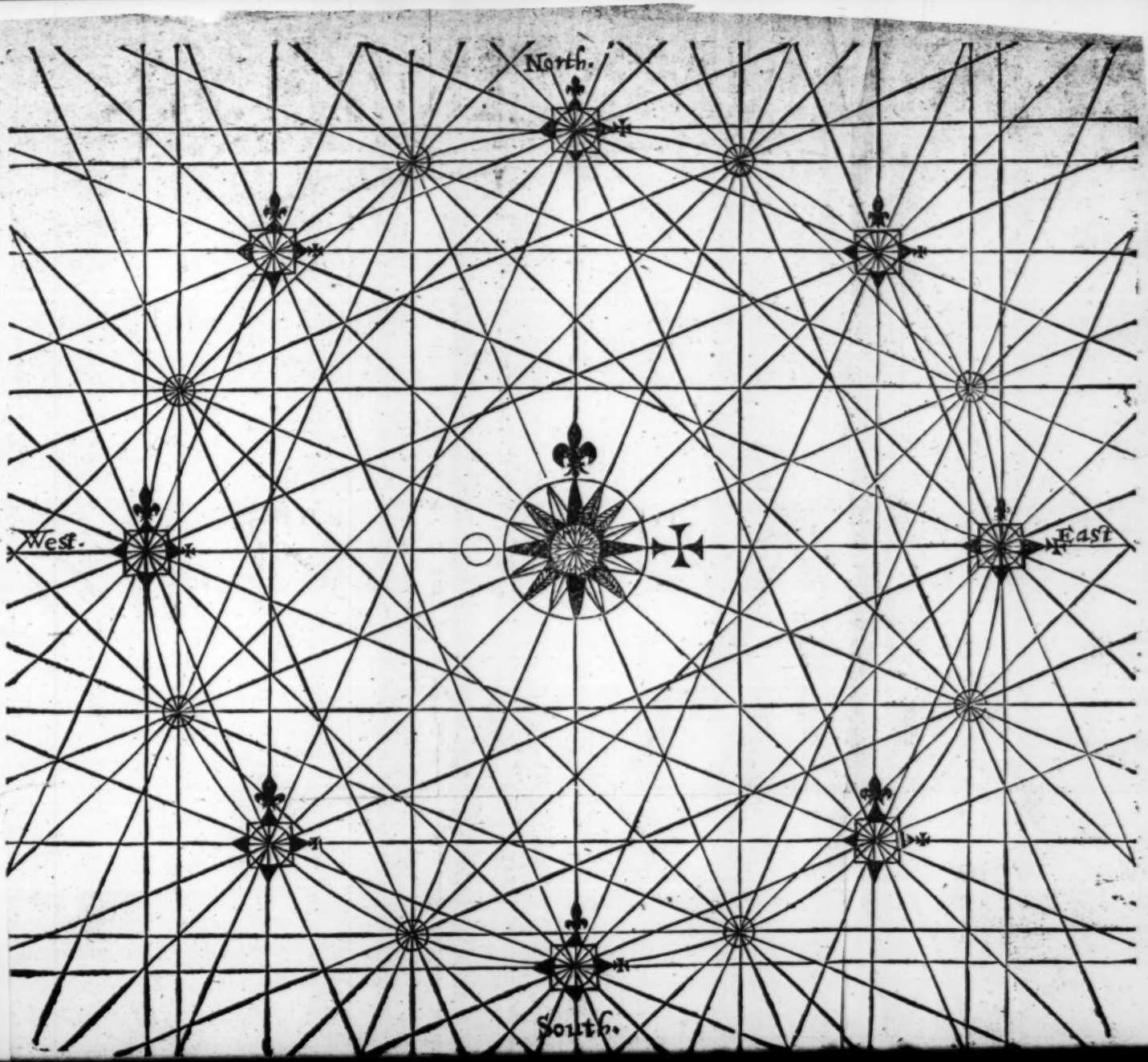
ridian ſignifying the axletree of the worlde, which line he extēded right out a good way northward beyond his Mappe, about the quantitie of the third part thereof, to the intent that the North end of that line ſignifying the North pole, might be the center whereon he had to drawe all his Paralels contained betwixt the 30 degrees and 70. degrees of North latitude: and for that purpoſe he deuided with his compaſſe the middle meridian beeing ſo extended from the 30. Paralel to the verie Pole, into 12. equal parts or ſpaces, & euery ſuch ſpace into 5 degrees which maketh in al 60 degrees, cōting thoſe degrees frō the nether ēd of the middle meridian croſſing the 30. Paralel vnto the foreſaide Center, vpon which center, ſetting the firme foote of his Compaſſe, and extending the other to the lower end of the ſaid middle Meridian wheras it croſſeth the 30. Paralel, he draweth his firſt paralel ſo far on both hands as his Carde will ſuffer him, which Paralel according to the quantitie of the ſpace of the degrees, he draweth through the pricks of diuiſion ſet downe in the middle Meridian, the reſt of the paralels vntill he come to the 70. degrees of North latitude, that done he deuideth as well the vpper Paralel as the nether Paralel, each of them into 20. equall parts or ſpaces, euery ſpace containing 5 degrees, through which diuiſions he draweth his Circular Meridians, or rather portions of circular meridians, ſome greater ſome leſſer by finding out fit centers to draw theron the ſaid portions of circles on both ſides of the middle Meridian through 3. ſeuerall pricks or points, whereof one muſt bee alwayes that which ſignifieth the north pole which is cleane without the Carde, and the other two pricks are to be ſought in the two paralels that are deuided, as before each of them into 20. parts, which 2. pricks muſt anſwere one another according to the like number of degrees of the ſaide 2. paralels, as 10. to 10. 20. to 20. and ſo forth. As for example, ſuppoſe that you would draw a Meridian that may paſſe through the 20. ſection of the thirtie paralel, and alſo through the twentie ſection of the 70. Paralel, and thirdly through the Pole: here to find out an apt center to draw this meridian, it is not eaſie vnles you haue an Inſtrument meete for the purpoſe like to that which Maſter Blagrave ſetteth downe in the 4. Booke of his Mathematicall Jewell Chap. 20. made according to the

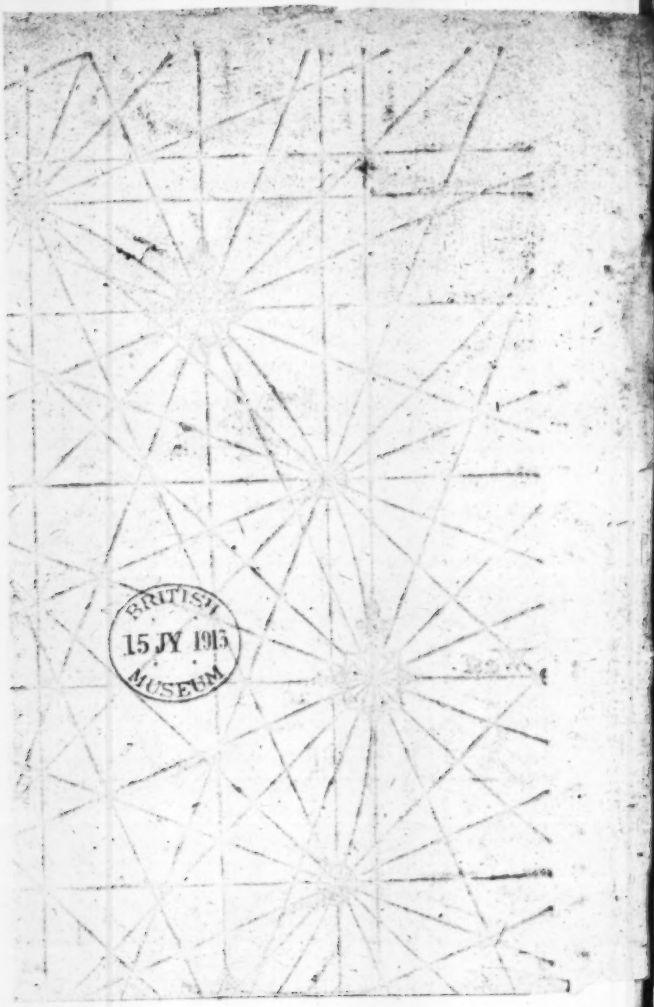
doctrine

doctrine of Euclide: for to finde out all the Centers of the ſaide Meridians in this little Carde according to Euclid his rule of drawing a circle through 3 pricks, would require an euen ſwath almoſt 40. foot ſquare.

Thus hauing drawne the Paralels and Meridians of his Card, he ſetteth downe therein all ſuch notable places as are cõtained in Europe, as Townes, Riuers, Seas, Ilandes, Mountaines and ſuch like, as wel according to their true longitudes, and latitudes, as alſo according to their due direction, that is to ſay, how one place beareth from another, as Eaſt, Weſt, North or South and ſo forth: wherein he was greatly holpen by the ſea Cards lately made by ſkilfull Pilots. And it ſeemeth by the card wherby I made this deſcription, that Mercator had an intention to ſet downe in the ſaid Carde certaine flies of direction to ſhew thereby how euery place doth beare each one from other, which Flies though they doe not all plainely appeare, yet the print off ſome of them is ſtil to be ſeen in the ſaid Card. I thinke that Mercator cauſed them to be cancelled for feare of occupying too much roome in his Carde, and therby to hinder the view of many places needfull to be ſet downe in the ſaid carde,

Moreouer he addeth to his ſaid card three ſeuerall ſcales, one of latitude the ſecond of longitude, and the third of diſtance: By the firſt you may eaſily find out the true latitude of any place & by the ſecond the true longitude of any place cõtained in the ſaide Card, and by the third ſcale you may know how many miles according to the diuerſitie of miles in euery ſeuerall region one place is diſtant from another, the deſcriptiõ and vſe of al which three ſcales hereafter followeth.


North.
West.
East
South.


BRITISH
15 JY 1915
MUSEUM

The deſcription and vſe of the ſcale of latitude

The ſcale of latitude conſiſteth of 4. right lines making 3. columnes, euery one containing in length one ſuch whole ſpace as is contained betwixt any two paralels ſet down in the Map, & as euery ſuch ſpace is diuided into 5 degrees, ſo likewiſe is the length of the ſcale as you may ſee by the number ſet downe in the firſt colume on the left hand thus 1, 2, 3, 4, 5 and euery degree is diuided into fiue equall partes, as you may perceiue by the ſecond colume, and euery ſuch part is diuided into 10. as you may perceiue by the third colume, ſo as euery whole degree is deuided into 00. the vſe of which ſcale is to find out the true latitude of any place contained in the Map thus.

Set the one foot of your compaſſe in the place whoſe latitude you ſeeke, extending the other foot to the Paralell which is nexte vnto that place, which paralel if it be beneath the place, then applie that widenes of your Compaſſe vnto the lower part of the ſcale, by ſetting the one foot therof at the loweſt end of the ſcale and the other foot vpward ſo far as the widenes will extend the looke how many degrees & minutes are contained betwixt the 2. feete of your compaſſe, & adde that vnto the number of the aforeſaid Paralel ſet downe in the map, and the ſum thereof ſhalbe the latitude of the place. But if you doe extend your compaſſe from the place whoſe latitude you ſeeke, to the nexte paralel aboue it: then you muſt applie that widenes of your compaſſe to the vpper part of the ſcale, ſetting one foot of your compaſſe in the verie toppe thereof, and the other downeward ſo far as that widenes will reach, then looke how many degrees and minutes are contained betwixt the two feete of your compaſſe, and ſubtract that from the number of the ſaid vpper paralel ſet downe in the map, and the remainder ſhall be the latitude of that place.

As for example, you would know the latitude of Rome which is the chiefeſt Cittie in Italie. Here hauing found out Rome in the mappe, you muſt firſt ſet one foot of the compaſſe in that verie place, extending the other foote vnto the nexte inferiour

Paralell

Paralel, that done keeping your Compaſſe at that widenes, apply the ſame vnto the ſcale, by ſetting one foote at the loweſt end of the ſcale, and the other vpward ſo farre as that wideneſſe will reach, then looke how many degrees and minutes are contained betwixt the two feete of your Compaſſe and you ſhal find it to bee one degree 4'8. which being added to the number of the foreſaid nert inferiour paralel, which is 40. ſet downe in the Map, it will make in al 41. degrees 4'8. and that is the latitude of Roome. But if you do extend your compaſſe from Roome to the nert vpper paralel, then in applying the widenes to the ſcale you muſt ſet one foote of your Compaſſe in the very toppe of the ſcale, and the other downeward, ſo farre as that widenes will extend, and by looking how many degrees and minutes are contained betwixt the two feete of your compaſſe, you ſhal find them to be 3. degrees 12. minutes which being taken from 45. which is the number of the nert vpper paralel, there will remaine 41. degrees 48. as before.

Then hauing the latitude of Roome, you may eaſily finde out the longitude thereof by help of the ſcale of longitude ſet downe in the map. the deſcription and vſe whereof hereafter followeth.

The deſcription and vſe of the Scale of longitude.

THis Scale as you ſee cõſiſteth of 30. long right lines ſignifying meridiãs, drawn frõ the left hand toward the right, whoſe ſpaces doe ware ſtraighter & ſtraighter towardes the Pole, which meridians are croſſed with 40. circuler paralels, proceeding orderly from the 30. paralel to the 70. euery one ſhorter than other towardes the Pole, as you may perceiue by the number ſet downe, as well aboue as beneath the ſcale, and as the firſt and greateſt parallell on the left hand is deuided into 5. degrees, and euery degree into ſix partes ſo is euery other paralel, be it neuer ſo ſhort, the vſe of which ſcale is thus. Firſt hauing found the latitude of any place by helpe of the ſcale of latitude before deſcribed, you muſt keepe your cõpas ſtil at the widenes of the latitude firſt foũd, & apply that ſame widnes vnto that meridiã which is neareſt vnto the place, by ſetting õe foot in the former paralel, wheras the nert meridiã doth croſſe the ſame, extending the other foot vpõ the ſaid meridiã vpwarde

ſo

so farre as that widenes will suffer, and there make a pricke, in which pricke set the one foote of your compasse, and extend the other to the place, and apply that last widenes to the scale of longitude, by setting the one foote in the nether side of the scale, at the very latitude before found, and extend the other vppon the same parallel of latitude, so farre vpward as that widenes will suffer: then looke how many degrees and minutes are comprehended betwixt the two feete of your Compasse, and adde that to the number of the foresaide next Meridian set downe in the Mappe, and if the same Meridian bee on the left hand of the place, then it is westerly from the place, but if the next Meridian which you take bee on the right hand standing on the East side of the place then you must subtract the degrees and minutes found in the scale of longitude from the number of that Meridian set downe in the Map, & the remainer shall be the longitude of the place. As for example, hauing found the longitude of Rome by helpe of the scale of latitude to be 41. degrees 48. as is aforesaide, here keeping your compasse still at the former widenes, apply the same to the next Meridian on the left hand by setting one foote in that point, whereas the said Meridian crosseth the parallel of latitude, and the other foote still vpon the same Meridian vpward so farre as that widenes will extend & there make a pricke, in which prick hauing set the one foote of your compasse, extende the other foote to the place where Rom stan deth, that done, applie that last widenes of your compasse vnto the nether part of the scale of longitude, by setting the one foote in the verie degree & minute of the former found latitude, and the other foote vppon the same degree and minute of latitude. Then looke how many degrees and minutes are comprehended betwixt the two feet of your Compasse, which you shall find to be 1. degree, 10. & by adding that to the number of the next Meridian on the left hand set downe in the Map, which is 35. degrees, it maketh in all 36. degrees 10. & that is the longitude of Rome. But if you make choyce of the next Meridian on the right hand, whose number is 40 degrees, then you must subtract the degrees & minutes contained betwixt the two feet of the compasse, which you shall finde to be 3. degrees 50. out of the next parallel on the left hande, which is 40 degrees, and there will remaine 36. degrees, 10. minutes as before.

The

The Scale of diſtance.

This Scale needeth no deſcription, becauſe it is plainely ſet downe in the Mappe, ſhewing the diuerſitie of Leagues or Miles belonging to euery Nation or Region, wherefore if you woulde know the diſtance betwixt any two places ſet downe in the Mappe, you haue no more to doe, but to take with your Compaſſe the iuſt diſtance betwixt theſe two places, and to apply that wideneſſe to the Scale by ſetting the one foote of your Compaſſe in the beginning of thoſe Miles, that are anſwereable to the Region, or rather to thoſe kinde of Miles which you ſeeke to know, and extend the other foote vppon that part of the Scale, ſo farre as that wideneſs will ſuffer you and the number of miles comprehended betwixt the 2. feet of your cõpaſſe will ſhewe you the true diſtance betwixt the two places. By this meanes you ſhall finde the diſtance betwixt Rome and Naples to bee 120. miles, but if the diſtance of the two places ſet down in the Mappe be longer then the ſcale it ſelfe, then you muſt firſt take the whole length of that part of the ſcale which is anſwereable to thoſe miles which you ſeeke. & by keeping your compaſſe at that wideneſs, to meaſure by a right line how many times the ſaide wideneſs is comprehended betwixt the two foreſaide places, and the number of miles ſhalbe the diſtance: but if there bee any odde meaſure: then you muſt ſtrayten your Compaſſe to anſwere that od meaſure, and apply that wideneſs to the beginning of the aforeſaide ſcale, and adde that to the former number, whoſe totall ſumme ſhall be the diſtance betwixt the two places.

Moreouer you ſhall finde on the right ſide of this Mappe the peregrination of the Apoſtle S. Peter, and right vnder that, the peregrination of S. Paule, ſhewing in how many places they preached the word of God, what miracles they did and where. And in the foot of the Mappe on the right hand is ſet downe the peregrination of Jeſus Chriſt, ſhewing the places where he preached or did any great miracles.

Finally

Finally aboute the middeſt of the Mappe you ſhall finde certaine Characters ſhewing which Townes are the ſeates of Biſhops, Archbiſhops, Patriarkes, Popes and ſuch like.

And thus I end praying you to take my labour herein beſtowed well in woꝛth, which I would not haue done but that I knowe this Carde to bee a neceſſarie Carde, and to bee made with very good Art, accoꝛding to the example of which Carde, the ſonne of old Mercator hath lately cut foꝛth diuers ſmall Cardes of Europe, traced with lines and circles, like to theſe of his Fathers Carde, the vſe of which lines and circles, I feare me that few doe rightly vnderſtand, and foꝛ that cauſe I was the moꝛe willing here to ſet downe this plaine deſcription of the Fathers Carde.

FINIS.

M. BLVNDEVILE
His Exerciſes, containing

eight Treatiſes, the titles whereof are ſet downe *in the next printed page: which Treatiſes are verie* neceſſarie to be read and learned of all young Gentlemen, *that haue not beene exerciſed in ſuch diſciplines*: and yet are deſirous to haue knowledge as well in Coſmographie, *Aſtronomie, and Geographie, as alſo in the* Arte of Nauigation, in which Arte it is impoſſible to profite without the helpe of theſe, or ſuch like inſtructions.

To the furtherance of which Arte of Nauigation, the ſaid *M.* Blundeuile *ſpecially wrote the ſaid Treatiſes, and of meere* goodwill doth Dedicate the ſame to all young Gentlemen of this Realme.

The third edition.



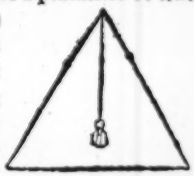
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1606.

How to place the Globe truly according to the foure quarters of the world, & according to the Latitude of any region.

The 1. Propoſition.

FIrſt in bedding your Globe together with the Brazen Meridian in the two nickes of the Horizon and alſo in the ſlit of the pinne which ſtandeth in the middeſt of the fore, ſo that the North pole of your Globe be anſwerable to the North quarter or North wind of the worlde, deſcribed vpon the Horizon, and ſee that that part of the Brazen Meridian, wherin are deſcribed ẏ Climes, Parallels and houres of the longeſt day, may ſtand aboue the Horizon, and alſo that the one halfe of the brazen Meridian may iuſtly and euenly appeare aboue the Horizon, and the other halfe vnder the Horizon: Againe, you muſt ſee that the Equinoctiall line of the Globe doe meete iuſt with the middle point or ſtreake of the brazen Meridian whereas the firſt degree of Latitude doth begin and alſo that the body of the Globe doe not leane to the one ſide of the Horizon more than to the other, but to be equally diſtant from the ſame in all places, & in any wiſe to ſee that the Horizon ſtand alwaies leuel, to which end ſome Globes haue a plummet of leade hanging by a little chaine or threede, which becauſe it will moue with euery wind, I for my part doe thinke it better for you to haue ſuch a little leuell made of purpoſe, as you may ſet the ſame vpon any place of the Horizon where you liſt, & thereby make ẏ Horizon to ſtand leuell on euery ſide as you wil



your ſelfe, and it may be made of a little peece of thicke boorde, like a Triangle thus.

Then with your two hands laying hold of the two next pillers, turne the foote of the Globe vntill it ſtand right North and South which is to be done thus. Firſt finde out the true Meridian of the place whereas you are to vſe the Globe by ſuch meanes as Maſter Burrough teacheth in his diſcourſe of the variation of the Compaſſe, the 7. Chapter, which vndoubtedly is a moſt certaine way, by which you ſhall finde three thinges at one inſtant, that is, the true Meridian, the variation of the needle, and the true Latitude of any place. But if you haue not the inſtrument of variation, by helpe whereof this matter is to bee accomplished, then in ſome open place betwixt 8. and 9. of the clocke in the forenoone or ſooner, vpon a ſmooth Table or plancke, ſtanding leuell, drawe a good large Circle with your Compaſſes, in the Center whereof muſt bee fixed a round and ſtraight pinne of Iron or Latton wyer, in length a good deale ſhorter then the Semidiameter of that Circle and to the intent that the pinne or ſtile may ſtande right vp, without inclining on either ſide, it would be rectified by a true Squire. That done, waite diligently vntill the ſhadow of the pinne heade doe iuſtly touch the circumference of the Circle, ſo as it neyther paſſe beyond the Circle, nor come ſhort of the ſame, and there make a pricke, and ſo let it ſtay vntill about three of the clocke in the afternone, about which time the ſhadow of the pinne will beginne to approch nigh vnto the ſaide Circle, and ſo ſoone as it toucheth the ſame, make there another pricke: that done, deuide the Arke or portion of the Circle, contained betwixt thoſe 2. pricks into two equall parts, and in the midſt thereof ſet another pricke, then laying your ruler to the middle prick, and to the Center of the Circle, drawe a right line through the Center and alſo through the middle pricke from the one ſide of the Circle to the other, and beyond if you liſt: for you may make the ſaide line of ſuch length as you ſhall thinke moſt meete to ſerue your turne, and that line ſhall be the true Meridian for that place, ſhewing the right North and South part of your Horizon, and by croſſing the ſame line with another right line in the very middeſt with right Angles, you ſhall haue the true Eaſt and Weſt, and to anoyde long waiting, you may drawe diuerſe Circles one with in another. Thus hauing

ming found the true North and South, East and West, place your Globe accordingly, so as the Brazen Meridian of the Globe may aunswere the Meridian line alreadie drawne vpon the boorde or planke, and to the intent that afterward you may knowe at all times both day and night, how to place your Globe right North and South, it shall be necessarie to drawe a right line vppon the foote of the Horizon, aunswereable to the foresaide Meridian first drawne vpon the boorde or planke, and vpon that line to fasten a prette handsome Compasse, having a needle of an inch long at the least, which is much more certaine, than such a little needle as is woont to bee set in the foote of euery globe: And when the needle standeth still, marke how much the North point thereof declineth either East or West, from the true Meridian before taken, and whereas you see the Needle to decline, bee it East or West, there set fast a little pinne of Latton to serue as a marke, whereto you may alwaies direct the North point of the needle when you would haue the Globe to stand right North and South, for there is no needle touched with the loade-stone, bee it neuer so good a stone, but it will varie from the true Meridian line, either more or lesse, and therefore no trust is to bee giuen to the needle vntill you know the true variation thereof, the finding of which variation, as I saide before, is most truely taught by M. Borough in his Booke before mentioned, whereunto I once againe refer you and the rather for that it is written in our mother tongue. But Gemma Frisius teacheth to set the Globe right North and South thus, first goe into an open place whereas the Sunne shineth, and vpon some Table standing leuel, and also the Globe standing leuell, the Pole being eleuated aboue the Horizon according to your Latitude, fixe a right needle in the degree of the signe, wherein the Sunne is that day, so as the needle may stand right vp without inclining any manner of way, and if it bee in the forenoone, turne the East side of the Globe towards the Sunne, mouing both the Globe and his seate to and fro, vntil you see the needle to cast no shadowe at all, for so shall the Globe stande right North and South. But if it bee in the afternoone, you must turne the West side of the Globe towardes the Sunne, and then worke as before, and by any of these wayes before taught you shall not onely place

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the Globe answereable to the foure quarters of the world but also you shall find that the Circles, Poles, and Arletrees of the Globe are answereable to the Circles, Poles, and Arletrees of the heauens. Now hauing placed your Globe answereable to the foure quarters of the world, learne to know by some Table or moderne Map, or else by such wayes as are set downe both in my Spheare and also in the latter end of this treatise, the Latitude of the Region wherein you dwell: As for example, the Latitude of these parties here about Norwitch is 52. degrees, then taking holde of the Brazen Meridian as well with your left hand aboue the Horizon, as with your right hand beneath the Horizon, turne the same vp and downe in the nickes of the Horizon vntill the North pole be eleuated aboue the Horizon 52. degrees, the last of which degrees must meete euen with the vpper brimme of the Horizon, that done, seeke for England in the Globe, not leauing to turne the body of the Globe to and fro vntill you haue brought that Meridian which passeth through England right vnder the Brazen Meridian, and holding it still at that stay, draw the heade of the Brazen quarter of altitude right ouer the place, and ouer that Meridian vnder which you dwell, so shall the head of your Brazen quarter stand for your Zenith in the verie middest of the Horizon and keeping all things thus at a stay, you may see how euery region or countreis situated, and how it beareth from you, and which be vnder your Climate and which be not, and to be sure that the Brazen Zenith may stand in his right place, it shall be needful to set it so as the left square side thereof made with a long notch may touch the selfe same degree of Latitude in the Brazen Meridian, which it hath of altitude, for looke how many degrees the Pole is eleuated aboue the Horizon, which is called the altitude, so many degrees must the brazen Zenith be distant from the Equinoctiall of the Globe: which is called Latitude, and is euer all one with the altitude of the Pole. Thus hauing shewed you how to place the Globe according to the foure quarters of the world, I thinke good now to declare vnto you, first the vses of the terrestriall Globe, whereof some are common also to the celestiall globe, as you shall perceiue hereafter by the propositions following, which propositions may be very well deuided into 3. sorts, whereof the

first

firſt doe properly belong to the deſcription of the vniuerſall Map, where with the terreſtriall Globe is couered, which are but few in number. The ſecond kinde of propoſitions doe chiefely belong to the Sunne, and to his apparances, which are alſo common to the celeſtiall Globe, and may be found out by either of the Globes. But the third kinde doe belong moſt properly to the fixed ſtarres and to their apparances, and therfore I mind not to ſet down them vntill I come to diſcribe the celeſtiall Globe, and to ſhew the vſes thereof.

The chiefeſt propoſitions belonging to the vniuerſall Mappe, wherewith the terreſtriall Globe is couered, are theſe following.

To know vnder what Clime any place or region is, and of how many houres the longeſt day is there, and alſo what Latitude any place deſcribed in the Map hath.

The 2. Propoſition.

HAuing ſet the Globe at your latitude, bring the place or region which you ſeeke right vnder the Brazen Meridian, and the vpper ſpace of the ſaide Meridian will ſhewe the Clime. And the ſecond or middle ſpace will ſhew the houres of the longeſt day. And the third ſpace the Latitude: As for example, if you woulde knowe vnder what Clime London is, then hauing found London, fixe a long needle in the red ſpot next to the name of London (for all townes for the moſt part in the Globe are marked with red ſpots) that done, turne the Globe with your hand vntill the needle doe touch the brazen Meridian, and by ſtaying the Globe there with your hand, you ſhall finde London to be vnder the 8. Clime, and that the longeſt day in the yeare is there 16. houres and 20. minutes, and the third and nethermoſt ſpace doth ſhew the Latitude of the place which is 51. degrees, 32. Againe, by obſeruing this order without changing your Latitude you ſhall find Venice to bee vnder the 6. Clime, and their longeſt day to be 15. houres and ſomewhat more, and

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the Latitude of that Cittie to be 44. degrees, 30. and you ſhall find Ieruſalem to be vnder the third Clime, and the longeſt day there to be 14. houres, and the Latitude thereof to be 31. degrees, 30.

How to know what Longitude any place deſcribed in the Map hath.

Propoſition. 3.

THe Globe ſtanding ſtil at your owne Latitude, pricke the necole in the place whereof you ſeeke the Longitude, and bring it as before, to the brazen Meridian, and ſtaying it there, looke at what number of degrees the brazen Meridian cutteth the Equinoctiall, and that is the Longitude of the place counting the degrees from the firſt degree of the Equinoctiall, which beginneth at the firſt point of Aries vnto the place of the ſection: by doing thus, you ſhall find the Longitude of London to be 19. degrees, and the Longitude of Venice to be 36. degrees, and the Longitude of Ieruſalem to be 67. degrees and 30. minutes.

How to know the diſtance betwixt any two places deſcribed in the Map.

Propoſition. 4.

OPen your Compaſſes ſo wide as you may ſet the one foote thereof iuſt in the one place, and the other foote in the other place, and apply that wideneſſe to the Equinoctiall line, counting how many degrees of the Equinoctiall are contained betwixt the two feete of your Compaſſes, & by allowing to euery degree 60. miles, you ſhall haue the

true

true diſtance of the places. Thus you ſhall finde the diſtance betwixt London and Venice to be 13. degrées, 30. which being multiplyed by 60. maketh 810. miles, and the diſtance betwixt London and Ieruſalem to be 40. degrées, 30. which being multiplyed by 60. maketh 2430. miles. And it maketh no matter to what part ſoeuer of the Equinoctiall you doe apply the wideneſſe of your Compaſſes, ſo as you ſet the firſt foote at the very beginning of ſome one degrée, and let the other foote fall out as it will, either at a whole degrée, at a halfe, or at a quarter of a degrée, which ſmall parts are to be counted by minutes by coniecturall diſcretion. And note here that no two places can be diſtant one from another Eaſt and Weſt more then 180. degrées which is iuſt the one halfe the circuit of the Earth, beyond which halfe or on this ſide thereof the places muſt needes be nearer together by meanes of the roundneſſe of the Earth, and if either of the two places whereof you would know the diſtance be not expreſſed in the Globe, then learne to find out the Longitude & Latitude thereof by ſome Table, whereof the firſt Meridian is ſuppoſed to paſſe through the Ilands of Canariæ, & marke vpon the Globe where the ſaid Longitude and Latitude doe croſſe, for there ought that place to ſtand which is miſſing, to which place direct the one foote of your Compaſſes and then worke as before is taught. And by this meanes you may alſo know the diſtance betwixt any two ſtars contained in the Globe.

To know how one place beareth from another.

Propoſition. 5.



THough you may partly find out this by marking the direction of the lines, proceeding from the Mariners Compaſſe ſet downe in the Globe: yet in mine opinion it is readier to do it by applying the Fly deſcribed in my little treatiſe of vniuerſall Mappes, vnto the Globe by ſetting the Center thereof vpon the firſt place from whence you goe, and by drawing

drawing a thread through that place where to you would goe, in ſuch order as is there taught, ſo you ſhall find Venice to beare from London South East and by East, and Ieruſalem to beare from London East, South East, and two quarters more towards the South. But Gemma Friſius teacheth to know by the Globe how one place beareth from another thus, hauing ſet the Globe and alſo the Zenith of the quarter of altitude at ſuch Latitude as the firſt place or region hath, from whence you would goe, bring that firſt place vnder the brazen Meridian, and there ſtay the Globe vntil you haue brought the quarter of altitude to the ſecond place and the neither end of the quarter of altitude will ſhew you vppon the Horizon amongſt the winds how the ſecond place beareth from the firſt, ſo ſhall you finde Hiſpaniola to beare from Spaine right Weſt, theſe be the chiefeſt propoſitions belonging to the vniuerſall Map, wherewith the terreſtriall Globe is couered, and therefore I will now ſet downe thoſe that belong to the Sunne, which may be done as well by the one Globe as by the other, and firſt how to finde out the place of the Sunne.

How to find out by the Globe the Place of the Sunne, that is to ſay, the degree and minute of that ſigne wherein the Sun is euery day throughout the yeare.

Propoſition. 6.

THough the ſureſt way bee to finde it out by the Ephemerides, which ſheweth the very minute, yet without hauing reſpect to the minute, you may finde it out by the Globe thus, ſeeke out the day of the moneth vpon the Horizon, and that will point you to the degree of the ſigne wherein the Sunne is that day: As for example, the 6. day of May pointeth right to the 25. degree of Taurus the Globe ſtanding leuel, and your rule being rightly laide vpon the Horizon but during the leape yeare you muſt adde one degree more then the Horizon ſheweth euery day from the beginning of the leape yeare throughout all that yeare.

How

How to rectifie the Index of the houre wheele for euery ſeuerall day throughout the yeare.

Propoſition.

HAuing placed ẏ Globe at your Latitude and alſo found out the degrꝛe of the Sunne as is before taught, bꝛing that degree of the Sunne to the Bꝛazen Meridian, & there ſtaying it with the one hande, turne with your other hande the Inder of the houre wheele to the higheſt part of the ſaid wheele marked with the number of 12. ſetting the point of the Inder iuſt with the ſtreeke of the wheele made to ſhew the houre of 12. oꝛ noonetide, and that will ſerue your turne foꝛ all that day, and thus muſt you doe euery day in which you haue to vſe the helpe of the ſaid houre-wheele foꝛ any purpoſe.

How to know euery day at what houre the Sunne riſeth or ſetteth.

Propoſition. 8.

HAuing ſet the Globe at your Latitude, & rectified the Inder of the houre-wheele by the 7. pꝛopoſition, turne the Globe to the Eaſt, ſo as the degree of the Sunne may touch the Hoꝛizon, and then the inder of the houre wheele will ſhewe you at what houre the Sunne riſeth, Againe, if you bꝛing the ſaide degree of the Sunne vnto the Weſt part of the Hoꝛizon, the Inder of the houre-wheele will ſhew you at what houre he goeth downe. As foꝛ example, Anno 1590. ẏ third of June, the Sunne being in the 21. degree 33′ of Gemini. I bꝛing the point to the veꝛy edge of the Hoꝛizon on the Eaſt part thereof, and there ſtaying

ing

ing it, the Inder of the houre whale ſheweth that the Sunne riſeth 8′. before foure of the clocke in the morning: and the ſaid point of the Ecliptique being turned to the Weſt part of the Horizon, the Inder ſheweth that he ſetteth 8′. after 8. of the clocke at night.

How to know in what part of the Horizon the Sunne riſeth and ſetteth euery day,

Propoſition, 9.

SEeke the degrée of the Sunne in the Ecliptique line, and turne it to the Eaſt part of the Horizon, then you ſhall ſée whether it riſeth iuſt Eaſt or not, and whether it inclineth towards the South, or towards the North, and likewiſe by bringing the ſaid degrée to the Weſt part of the Horizon, you ſhall ſée in what part of the ſaid Horizon he goeth downe: As for example, in the laſt propoſition the Sunne being in the 21. degrée, 33. of Gemini, and brought to the Eaſt part of the Horizon, I find that the Sun did riſe diſtant from the Eaſt towards the North 38. degrées, 30. of the Horizon, which is three points and ſomewhat more of the Mariners Compaſſe from Eaſt, towardes the North, ſo as the Sunne riſeth Northeaſt and by Eaſt, and a little more Northward, and the ſaid place of the Sunne being brought to the Weſt part of the Horizon, I find that he ſetteth North Weſt ⅓ by Weſt and ſomewhat more Northward.

How

How to know the length of euery day and night throughout the yeare, as well by help of the houre wheele as by counting the degrees vpon the Horizon.

Propoſition. 10.

FIrſt you muſt know when the Sun riſeth and ſetteth by the eight propoſition, then loke how many houres the Inder doth go from the Sunne riſing to the Sun ſetting, and that is the length of the day, which number if you take from 24. the night will appeare: as for example, knowing by the 8. propoſition, that the Sunne being in the 21. degrée, 3′3. of Gemini, riſeth 8′. before 4. in the morning, and goeth downe 8′. after 8. of the clocke at night, I find by counting the houres which the Inder of the houre whéle hath run, that the length of the day is 16. houres ⁊ 1′6. which you may know alſo by counting the degrées vpon the Horizon from the place of the Sunnes riſing, vnto the South point of the ſaid Horizon, which you ſhall finde to be 128. degrées, which being doubled maketh 256. degrées, which if you diuide by 15. it will make 16. houres and 1′6. as before.

How to know by the Globe how much the Sun declineth euery day throughout the yeare from the Equinoctiall.

Propoſition. 11.

HAuing found the place of the Sunne, bring the ſame to the Brazen Meridian, and by counting how many degrées are betwixt that place and the Equinoctiall, you ſhall know what declination the Sun hath that day: As for example, ſuppoſing the Sun that day you ſéke to be in the firſt degrée of Gemini, bring the ſaid degrée of the Ecliptique

cliptique to the brazen Meridian, and you ſhall find vpon the ſame Meridian the Sunne to be declined from the Equinoctiall Northward almoſt 20. degrees. Againe, ſuppoſing the Sunne to be in the firſt degree of Aquarius, if you bring the ſaid degree of the Ecliptique vnto the Meridian, you ſhall finde the declination of the Sunne to be almoſt 20. degrees Southward.

How to know by the Globe the Meridian altitude of the Sun, that is to ſay, his height at noonetyde euery day throughout the yeare, & how far he is then diſtant from your Zenith.

Propoſition. 12.

BRing the place of the Sunne that day you ſeeke to the brazen Meridian, and ſtaying it there, count vpon the ſaid brazen Meridian, how many degrees are contained betwixt the place of the Sunne & the South point of the Horizon, and that is the Meridian Altitude of the Sunne for that day, which if you ſubtract from 90. the remainder will ſhew how many degrees he is diſtant that day at noontide from your Zenith: as for example, ſuppoſing the Sun to be that day you ſeeke in the firſt degree of Taurus, bring that degree of the Ecliptique to the brazen Meridian, and ſtay it there vntill you haue counted how many degrees of the ſaid Meridian are contained betwixt the place of the Sunne, and the South point of the Horizon, and you ſhall finde the number of degrees to be 50 which is the Meridian altitude of the Sunne for that day, which 50. degrees being taken out of 90. there remaineth 40. and ſo many degrees the Sunne is that day at noone tide diſtant from your Zenith. The like order is to be obſerued in ſeeking to know the Meridian altitude of any Starre, or any other point in heauen.

How to know the altitude of the Sunne at any other houre of the day.

Propoſition, 13.

HAuing rectified the Inder of the houre whæle by the ſeuenth propoſition, if the houre which you ſæke be in the forenoone, turne the Globe ſo as the Inder of ỹ houre whæle may touch that houre of the forenoone, at which you deſire to know the altitude of the Sun, & there ſtay the Globe, vntill you haue brought the quarter of altitude on the Eaſt ſide of the Globe vnto the place of the Sunne, ſo ſhall you find vpon the ſaid quarter the altitude of the Sunne at that houre. And if you deſire to know the altitude of the Sun at any houre in the afternoone, then turne the Globe ſo as the Inder of the houre whæle may touch the houre of the afternoone, and there ſtay the Globe vntill you haue brought the quarter of altitude on the Weſt ſide of the Globe vnto ỹ place of the Sunne, & the ſaid quarter will ſhew you the altitude of the Sunne at that houre. As for example, I would know how high the Sunne is at 8. of the clocke in the morning, the Sunne being in the firſt degrée of Taurus: here hauing rectified the Inder of the houre whæle, I turne the Globe ſo as the Inder of the houre whæle may lie vpon the 8. houre of the forenoone, and there I ſtay the Globe vntill I haue brought the quarter of altitude on the Eaſt ſide of the Globe vnto the place of the Sunne: whereby I find the altitude of the Sunne at that houre to be almoſt 28. degrées. Againe, if you will know how high the Sunne is being in the ſame degrée of the Ecliptique at 5. of the clocke in the afternoone, then turne the Inder of the houre whæle, ſo as it may touch that houre, and ſtay it there vntill you haue brought the quarter of altitude on the Weſt ſide of the Globe vnto the place of the Sun, ſo ſhall you find the altitude of the Sunne to be at that houre 21. degrées.

How

How to know the houre of the day by the Globe.

Propoſition. 14.

THis is to be done two manner of wayes, the firſt is thus, ſet the Globe in ſome open place whileſt the Sunne ſhineth, and you muſt ſee that it ſtand both leuell and alſo right North and South, as is taught in the firſt Propoſition, and that the Inder of the houre wheele be rectified according to the degree of the ſigne wherein the Sunne is that day by the ſeuenth Propoſition, that done, fixe a needle in the place of the Sunne, and turne the bodie of the Globe to and fro vntill the needle caſt no ſhadow at all, and there ſtaying the Globe, the Inder of the houre wheele will ſhewe you the houre of the day. But if you ſeeke the houre in the forenoone, remember to turne the Eaſt ſide of the Globe towardes the Sunne, if in the afternoone, then turne the Weſt ſide of the Globe towardes the Sunne. The ſecond way is thus, hauing rectified the Inder of the houre wheele, take the altitude of the Sunne with ſome Quadrant or Aſtrolabe, and hauing marked the ſame altitude vppon the quarter of altitude, applye it to the degree of the Sunne on the Eaſt ſide of the Globe if it be in the forenoone: but if it be in the afternoone applie the quarter of altitude to the degree of the Sunne on the weſt ſide of the Globe, and the Inder of the houre wheele will ſhew you the houre which you ſeeke. As for example, the 6. of Iune 1590. the Sunne being in the 24. degree, 24. of Gemini, I found by my Aſtrolabe the altitude of the Sunne to be 48. degrees, which I marked vppon the quarter of altitude, and becauſe I tooke the altitude of the Sunne in the forenoone, I brought the quarter of altitude marked with that degree to the place of the Sunne on the Eaſt ſide of the Globe, and there ſtaying the Globe I found that the Inder of the houre wheele did point to the ninth houre of the forenoone and ſomewhat paſt. The like is to bee done to know any houre of the afternoone, ſo as you forget not to apply the quarter of altitude vnto the place of the Sunne on the Weſt ſide of the Globe.

And by taking the altitude of any knowne Starre, and working in like manner as before, you ſhall knowe the houre of the night as ſhall bee taught hereafter whenwee come to treat of the Starres.

To know how much the vnequall houres otherwiſe called the planetarie houres doe differ from the Artificiall houres throughout the yeare, and how many minutes euery vnequall houre containeth.

Propoſition. 15.

FIrſt you muſt know by the 10. Propoſition the length of the day, that is to ſay, how many houres it is long, and reduce theſe houres into minutes and diuide the product by 12. and the quotient, together with the remainder (if there be any left after the diuiſion) will ſhew you the quantitie of the vnequall houre of the day, that is to ſay, howe many minutes it containeth The like is to be done to know the vnequall houre of the night, for hauing the length of the artificiall night, worke as before, and you ſhall haue your deſire: As for example, knowing by the 10. propoſition the length of the day when the Sunne is in the 21. degree, 3'3. of Gemini to bee 1'6. houres 1'6. here by reducing thoſe houres into minutes, and by deuiding the product thereof by 12. you ſhall find the vnequall houre of the day to containe 81. minutes and $\frac{1}{2}$. of a minute or 20 ſeconds, which is more than one whole artificiall houre of the day by 21. minutes and 20. ſeconds. Againe, knowing the length of the artificiall night by the ſaide propoſition to be 7. houres, 44. minutes, if you do reduce the ſame into minutes, and deuide, by 12. you ſhal finde thereby the vnequall houre of the night to containe no more but 38. minutes, and 40, ſecands, which is leſſe then the artificiall houre of the day by 21. minutes, and 40. ſeconds.

How

How to know euery day when the dawning of the day and the twilight of the night beginneth and endeth, and the time of their continuance.

Propoſition. 16.

HAuing rectified the Inder of the houre-whæle by the ſeuenth Propoſition, firſt find out the oppoſite point to the degrée of the Sunne, and turne the Globe together with that oppoſite point, and alſo together with the quarter of altitude towards the Weſt, ſo as the oppoſite point may méete euen with the 18. degrée of the quarter of altitude, & ſtaying the globe there, the Inder of the houre wheele will ſhew at what houre the dawning beginneth. As for example, I would know at what houre the dawning of the day beginneth the 19. of Aprill 1590. when as the Sunne is in the 8. degree of Taurus, the oppoſite point whereof is the 8. degree of Scorpio, wherefore I turne the Globe together with the ſaid point oppoſite and alſo together with the quarter of altitude towardes the Weſt, ſo as the ſaid point oppoſite may meete euen with the 18. degree of the quarter of altitude, and there ſtaying the Globe, I finde by the Inder of the houre-wheele, that the dawning of the day beginneth at two of the clocke in the morning and 20. minutes after, which dawning alwaies endeth when the Sun riſeth, as in the former example, the Sunne being in the 8. degree of Taurus doth riſe 45. minutes after 4. of the clocke in the morning, ſo as the continuance of the dawning is two houres and 25. minutes, for by taking two houres and 20. minutes out of 4. houres and 45. minutes, there remaineth two houres and 25. minutes. Againe, the twilight beginneth when the Sunne goeth downe, which in the former example is at 7. of the clocke and 15. Now to know when the twilight endeth, you muſt doe thus, turne the Globe and the quarter of altitude towards the Eaſt, ſo as the oppoſite point, which is the 8. degree of Scorpio

may mæte euen with the 18. degræ of the ſaid quarter, and the Inder of the houre whæle will ſhew you the twilight endeth at 9 of the clocke and 4′5. after, ſo as the continuance of the twilight is two houres, and 3′0. for by taking ſeuen houres and 1′5. out of 9. houres and 4′5. there remaineth two houres and 3′0. But you haue to vnderſtand, that the dawning and twilight is not alwaies to be knowne throughout the yeare by the Globe, for from the 11. day of May to the 10. of July, you ſhall finde that the oppoſite point of the Sunne will not agree iuſt with the 18. degree of the quarter of Altitude: becauſe that no oppoſite point during that time will amount to aboue 16. or 17. degrees of the quarter of altitude at the moſt, becauſe the Meridian altitude it ſelfe of any ſuch oppoſite point is not aboue 17. degrees, for during all that time both dawning and twilight had neede in this our Latitude to be accounted as night, vnleſſe you will make no night at all.

How to know the aſcention of the Sunne both right and oblique.

Propoſition. 17.

SEtting the Globe at your Latitude, bring the degree of the Sunne to the Brazen Meridian, and there ſtaying it, marke at what number of degrees the ſaid Meridian cutteth the Equinoctiall, counting that number from the firſt point of the vernall Equinoctiall point to that ſection, and that is the right aſcention. As for Example the Sunne being in the firſt degree of Gemini and brought to the Meridian, you ſhall find that the Meridian cutteth the Equinoctiall in the 58. degree thereof, and that is his right aſcention. Now if you would know his oblique aſcention, being in the firſt degree of Gemini, bring that degree to the Eaſt part of the Horizon, ſo as it may touch the vpper edge thereof, and ſtaying the Globe there, looke what degree of the Equinoctiall toucheth the Horizon at that inſtant, which you ſhall finde

to

to be the 30. degree of the Equinoctiall, and that is his oblyque aſcention. Theſe are the chiefeſt propoſitions that belong to the Sunne, and are to be found by either of the Globes, wherefore I will now proceede to thoſe propoſitions that are to be known moſt properly by the celeſtiall Globe, But firſt I will make a deſcription of the ſaide celeſtiall Globe, whereby it ſhall plainely appeare wherein the one Globe is like the other, and wherein the one diffe-reth from the other.

The 18. propoſition, containing the diſcription of the celeſtiall Globe, and ſhewing wherein it is like or differing from the terreſtriall Globe.

Propoſition, 18.

THe Celeſtiall Globe is like to the terreſtriall Globe, in that it is round, hauing both like Arletrees, Poles, hourcwheele with his Inder, brazen Meridian, quarter of altitude of braſſe or Latton with his ſquare head or Zenith, and a halfe circle of braſſe or Latton called the ſemicircle of poſition alſo a ſtanding foote with an Horizon of wood diuided into 7. ſeueral ſpaces, containing in a maner the ſelfe ſame things that are before deſcribed in the Horizon of the terreſtriall Globe, alſo in the body of the celeſtiall Globe, are ſet downe certaine Circles like vnto the terreſtriall Globe, that is to ſay, the Equinoctiall and the Ecliptique line. Moreouer the foure leſſer Circles, that is to ſay, the two tropiques, the Circle Arcteque, and the circle Antarctique. But the Celeſtiall Globe differeth from the terreſtriall Globe in theſe foure things following. Firſt the celeſtiall Globe hath one thinne demicircle of braſſe or Latton more than the terreſtriall Globe hath, which Demicircle is diuided into two quarters each quarter containeth 90. degrees, made ſo at ech ende as it may bee faſtned when neede is, vppon the two Poles of the Zodiaque, to finde thereby the Longitude and Latitude of euery Starre deſcribed in the Globe, and therefore may be-

ry well be called the Semicirle of Longitude and Latitude. The ſecond difference is, that whereas the terreſtriall Globe is traced with 12. Meridians, deuiding the Equinoctiall into 24. ſpaces, euery ſpace containing 15. degrees. The celeſtiall Globe is onely traced with 6. Meridians, diuiding the Equinoctiall into 12. ſpaces, euery ſpace containing 30. degrees. The third difference is that the celeſtiall Globe hath not thoſe 8. Parallels of Latitude wherewith the terreſtriall Globe is traced. The fourth difference is that whereas the terreſtriall Globe is couered with an vniuerſal Map containing the foure principall diuiſions of the earth, that is, Europa, Africa, Aſia, and America: the celeſtiall Globe is couered with a Map, wherein are painted all the fixed Starres that were knowne to the auncient Aſtronomers deuided into 48. Images, with which Images, to the intent you might be the better acquainted, and that you might the more readily finde out any Starre deſcribed in the Globe, I thought good to ſet downe a particular deſcription of the ſaid 48. Images as followeth.

The 19. Propoſition, containeth a particular deſcription of the 48. Images of the fixed Starres that are in the celeſtiall Globe together with their ſundrie names and alſo the names of ſo many Starres as are named in the Globe, of which 48. Images 21. are aſcribed to the north parte of the firmament, 12. to the Zodiaque, 1 and 5. to the South part of the firmament.

Propoſition. 19.

THis deſcription is deuided into two partes according to the twofolde declination of the fixed Starres, that is to ſay, Northern and Southern for thoſe Starres are ſaide to haue North Declination, which are ſituated betwixt the Equinoctiall, and the North pole, and thoſe to haue South declination which are ſituated betwixt the Equinoctiall, and the South pole, and becauſe that fiue great Circles or Meridians, paſſing through the Poles of the world do deuide

deuide the Equinoctiall into twelue equall ſpaces, euery ſpace containing 30. degrees, I will begin my deſcription at the firſt point of Aries, which is the Uernall Equinoctiall point, and ſo proceed towards the right hand round about the Globe, ſetting downe all ſuch Images, or parts of Images as are ſituated towardes the North pole, and are contained in euery ſeuerall ſpace betwixt two Meridians, and hauing deſcribed all the North part, I will vſe like order in deſcribing the South part. And you may behold all the Northerne Images by turning the Globe about with your hand without taking the ſame out of his bed or ſeate, the pole being eleuated aboue the Horizon. 50. or 60. degrees, but to viewe the Southerne Images, it ſhal be needfull to take the Globe cleane out of his ſeate, and to hold it ſo as the North pole may ſtand right vp, ſo ſhall you ſee euery Southerne Image and Starre at your pleaſure And yet to know how the Starres are ſituated in heauen, you had neede to imagine your ſelfe to be within the Globe, in the very center thereof and not without the Globe for otherwiſe thoſe ſtarres that are ſituated in heauen on your right hand, if you haue regarde to the outſide of the Globe, will ſeeme to be on your left hand.

The Northern Images cõtained in the firſt ſpace intercepted betwixt the firſt Meridian and the ſecond Meridian.

IN this ſpace you ſhall firſt ſee next vnto the Equinoctiall the following Fiſh of the ſigne Piſces together with the bond, both Southerne and Northerne, called in Latine Linum auſtrale & Septentrionale, alſo the knote of the bonde, which is called Nodus, Syndeſmon, and hipouraion, which is a faire ſtar of the third bignes.

Item the firſt part of Aries with the two Starres in his right horne from the former Starre, whereof the Aſtronomers doe alwaies make their computation.

Item the whole Image of Andromeda, her heade and right arme excepted, in whoſe girdle is a Starre of the third bignes called Mirach, and in her left foote a Starre of the third bignes called Alamac.

Item

Item the Triangle called Triangulus and Deltoton with his foure ſtarres.

Item the whole Image of Caſsiopeia ſauing her right arme, and the vpper part of the backe of her chaire, in whoſe breſt is a ſtarre of the third bignes called Shedar.

The Northerne Images contained in the ſecond ſpace.

FIrſt the head of the Whale called Cetus in whoſe ſnout is a ſtarre of the third bigneſſe called Menkar,

Item all the hinder parts of Aries called in Greeke Chrios, in Engliſh the Ram.

Item the right legge, necke, breaſt, right eare, and mozell of the Bull, in whoſe right thigh towards the ſhoulder pointe is a ſtarre of the fourth bigneſſe called Alſon and in his breaſt a ſtarre of the third bigneſſe called Alſo, and in his Mozell lying vpon his right legge, is another ſtarre of the third bigneſſe called Alſon, and in his necke towards the Withers are 7. ſtars of diuers bignes called by theſe diuers names, that is, Vigilie, Atlantides, Pleiades, and Athoratæ, commmonly called the ſeuen Starres.

Item the whole head of Meduſa, called Caput Meduſæ vel Gorgonis, and Ras Algol.

Item the whole image of perſeus otherwiſe called Chelube, his right hand, ſwoꝛde, and right foote excepted.

The Northerne Images contained in the third ſpace.

FIrſt the left leg of the bull hauing 2. ſtarres thereon: moꝛeouer his head, hoꝛnes and moſt part of his right eare, on whoſe left eye is a ſtarre of the firſt bigneſſe, called Oculus Tauri, palilicium, and Aldebaran, alſo in his face are certaine leſſer ſtarres called ſuculæ and Hyades.

Item the vpper part of Orion otherwiſe called Alguze, holding a clube in his right hande, and a Lyons ſkin in his left hand on whoſe right ſhoulder is a ſtarre of the firſt bigneſſe called Bed Alguze, & on his left ſhoulder a ſtar of the ſecond bigneſſe called Bellatrix.

Item

Item the left foote of the former Gemini, containing two ſtars of the fourth bigneſſe, whereof the one is called Propous.

Item the whole Image of Auriga, otherwiſe called Erichonius and Heniochos, holding a reane & a whip in his right hand and hauing a Goate hanging on his backe, which hath two little Goates ſucking her behinde, which be two ſtarres of the ſecond bigneſſe, called by diuers names, as Hedi, Heriphoi, and Sadateni, and in the flanke of the Goate is a ſtarre of the firſt bigneſſe called hircus, aix, holenie and Alhaiot.

The Northerne Images contained in the fourth ſpace.

FIrſt the whole Image of the little Dog, in whoſe left flanke is a ſtar of the firſt bignes called Canis minor, Procion, Algomeiſa, and Alſahere.

Item the whole Image of the two twiſtnes called Gemini or Didimoi, the left foote of the former twin onely excepted, which former twin is called Apollo, Caſtor, Anhelar, and the other is called Pollux, and Abrachaleus, in whoſe left eare is a ſtarre of the ſecond bigneſſe called Ras Alguze.

Item the taile and halfe body of Cancer.

Item the Wozell of the great Beare, whereon is a ſtarre of the fourth bigneſſe.

The Northerne Images contained in the fift ſpace.

FIrſt the head and necke of Hydrus.

Item the forepart of Cancer called in Greeke Carchinos, vpon whoſe right Clea is a ſtarre of the fourth bignes called Acubene, and betwixt his head and his right Clea is a ſtarre called Preſepe, Phatue, and Meelleph, and on his backe are two ſtarres called Aſelli and Onoi.

Item the forepart of Leo againſt whoſe hart is a ſtarre of the firſt bigneſſe, called with theſe names, Cor Leonis, Regulus, Baſileus, and Calbalezet.

Item the forepart of the great Beare called Vrſa maior, Arctos Eliche, and Caliſto.

The

The Northerne Images contained in the ſixt ſpace.

FIrſt the hinder parts of Leo otherwiſe called Alezet, in whoſe taile is a ſtarre of the firſt bigneſſe called Cauda Leonis, and Deneb Alezet.

Item the head and ſhoulders of Virgo.

Item the darke ſtarre of Bernices haire.

Item the hinder parts of the great Beare, his tayle excepted.

Item the hinder parts of the Dragons taile, containing two ſtarres of the fourth bignes.

The Northerne Images contained in the ſeuenth ſpace.

FIrſt, the moſt part of Virgo, who is otherwiſe called Parthenos, Erigone, Preuindemiator, Protigiter Almucedie, and Alaraph.

Item the left leg and left arme of Bubulcus, otherwiſe called Bootes, Vociferator, Arctophilax and Lanceator, betwixt whoſe legges is a ſtarre of the firſt bignes called Arcturus, Aſimech, and Alramech.

Item Bernices haire, called Cincinnus, Ceſaries, plochamos, Berenices crinis, and Trica.

Item the tayle of the great Beare containing three ſtarres of the third bignes, wherein that next his rumpe is called Aliot, and that which is in the tippe of his tayle, is called Benenacz.

Item a part of the Dragons taile containing two ſtarres ſtanding nigh together nigh vnto the Circle Arctique.

The Northerne Images contained in the eight ſpace.

FIrſt the head and necke of the ſerpent called Anguis Serpens, Engchelis and Ophis.

Item the crowne of Ariadna, called Corona gnoſia Stephanos Ariadnis, and is commonly called Corona Septentrionalis that is, the Northern Crowne, in which is a Starre of the ſecond bignes called Malſelcare, Alpheta and Muniir.

Item

Item the moſt part of the Image of Bubulcus, hauing a club in his right hand, in whoſe left ſhoulder is a Starre of the fourth bigneſſe called Ceginus, and there is another of the fourth bigneſſe in his club, right againſt his face called Incalurus.

Item the hyre part of the little Beare called Vrſa minor, arctos and Cinoſura.

The Northerne Images contained in the ninth ſpace.

FIrſt ỹ vpper part of Serpentarius, otherwiſe called Ophiouchos and alangue in the Crowne of whoſe head is a ſtar of the third bigneſſe called iras alangue.

Item the whole Image of Hercules with the Lyons ſkin hanging on his left arme, otherwiſe Engonaſi, algethi, Neſſus, and ignotum idolum (his right hand holding the club, & his right leg excepted) in whoſe head is a ſtarre of the third bigneſſe, called Ras Algethi, and this Image lyeth groueling with his heeles towards the Nozth pole, and his head towardes the Equinoctiall, which meeteth almoſt with the heade of Serpentarius.

Item the head of the Dragon called Draco ℞ Aben, in whoſe head is a Starre of the third bignes called Ras Aben.

Item a part of his tayle contayning 6. ſtarres.

Item the hinder part of the little Beare, contayning two ſtars.

The Northerne Images contained in the tenth ſpace.

FIrſt, the vpper part of Antinous, hauing at each elboe a ſtar of the third bigneſſe.

Item the laſt end of the Serpents tayle, in the tip whereof is a ſtarre of the fourth bignes.

Item the whole Image of the Eagle called Aquila, Vultur volans, Aetos and Alcair.

Item the whole Image of the Shaft called Sagitta, Telum and Hoiſtos.

Item the whole Image of the Harpe called Lira and Alohore that is to ſay, Vultur cadens, and Chelis, in the vpper part whereof towards the left hand is a faire ſtarre of the ſecond bigneſſe called

leo

led Fidicula, lira, Alangue, vega, and Brineck.

Item the head, necke, and left wing of the ſwan, called Auis Ciguus, Olor, Hornis, Adigege, and of ſome Gallina.

Item the necke, body and foze part of the Dragon contayning 11. Starres.

Item part of the little Beares taile, containing one Starre next to his rumpe of the fourth bignes.

The Northerne Images contained in the 11. ſpace.

FIrſt, the Crowne of Aquarius his head, contayning one Star of the fift bignes.

Item the little hoꝛſe called Equus and Hippos, whoſe necke is incloſed with a cloud, and in his head are foure little ſtarres.

Item the head and two foꝛe feet of the winged hoꝛſe called Pegaſus, on whoſe right noſtrell is a ſtarre of the third bignes called Eniph Alpharaz.

Item the Dolphin called Delphinus, contayning ten Starres whereof one is of the third bignes.

Item the body, legs, and the right wing of the ſwan, which lyeth on her backe with her bellie vpward, in whoſe body towards the taile, is a faire Starre of the ſeconde bignes called Deneb Adigege, and Arided.

Item the right arme and right leg of Cepheus, on whoſe right ſhoulder is a ſtar called Alderaimim.

Item part of the little Beares taile contayning the middle ſtarre of his tayle.

The Northerne Images contayned in the 12. ſpace.

FIrſt, the moſt part of the foꝛmer fiſh of the ſigne Piſcis together with part of her band.

Item the necke, body and wing of Pegaſus, otherwiſe called Equus Gorgoneus, and Alpharaz, riſing out of a cloud. in which cloud is the head of Andromeda, hauing on the right ſide thereof a faire ſtarre of the ſecond bignes, and in the right wing of Pegaſus is a ſtarre of the ſecond bignes called Marcab Alpharaz,

and

and on his right ſhoulder another Starre of the ſecond bigneſſe called Scheat Alpharaz.

Item the right arme and hand of Andromeda holding part of her chaine, in the ring whereof is a Star of the fourth bigneſſe.

Item the right arme of Cepheus.

Item the tip of the little Beares taile, in which is the North Starre called Alrucuba of the third bigneſſe.

The names of the images contained in the celeſtiall globe betwixt the Equinoctiall and the South Pole together with ſo many ſtars as are named in that part of the globe, beginning as I did before in deſcribing the Northerne Images at the Vernall Equinoctiall point, and ſo proceede from ſpace to ſpace contained betwixt euery two Meridians towardes the right hand.

The Southerne Images contained in the firſt ſpace, beginning at the Vernall Equinoctiall point

FIrſt the moſt part of the Whale called Cetus. Piſtrix, and Balena (his head and fore part of his belly excepted) in the mid body whereof towards the backe, is a ſtarre of the fourth bigneſſe called Baten Kaetos, and in the lower part of his taile is another ſtarre of the third bigneſſe, called Deneb Kaitos.

The Southerne Images contained in the ſecond ſpace.

THe fore part of the Whales belly and his ghilles, containing fiue Starres

Item the moſt part of the floud Eridanus, called of ſome Nilus, and in Greeke Potamos Eridanos, containing 22. ſtarres, whereof one is called Angetenar, which is about the middeſt of the Floud nigh vnto the Whales belly, and there is in the very ende of the Floud another ſtarre of the firſt bigneſſe, called Acarnar.

The Southerne Images contained in the third ſpace.

Firſt

FIrſt, the nether part of Orion or Alguze from the middle of his backe downeward, in whoſe girdle are three faire Starres, whereof the middle ſtarre is of the ſecond bigneſſe called Orion or Alguze.

Item another part of the floude Eridanus which ſéemeth to come from the left foote of Orion, which ſtarre in the left foote is called Algebar, Rigel, Alguze.

Item the whole Image of the Hare, called Lepus and Lagos containing 12. little ſtarres.

Item the reſt of Eridanus containing foure Starres, whereof there is one called Beemum of the fift bigneſſe.

The Southerne Images contained in the fourth ſpace.

FIrſt, the whole Image of the great Dog called Canis maior, and Syrios in whoſe mouth is a ſtarre of the firſt bignes called Alceher and Alhabor.

Item the forepart of the great ſhip Argos, with her two Oares having a ſcutcheon with 4. Starres, the greateſt whereof being of the third bignes is called Markeb, and vnder the vpper hatches in the forepart of the ſhip is a Starre of the fift bigneſſe called Alphard, and in the left Oare towards the South pole, is a faire ſtarre of the firſt bigneſſe, called Canopus and Suhel.

The Southerne Images contained in the fift ſpace.

FIrſt, the mid part of the Serpent called Hydrus and Aſuia, in the which is a faire ſtar of the ſecõd bignes called Alphard.

Item the hinder part, maſt and toppe of the ſhip Argos, which ſéemeth to come out of a cloud, containing diuers Starres of diuers bignes without name.

The Southerne Images contained in the ſixt ſpace.

ITem another part of Hydrus whereupon ſtandeth the Image of the cuppe or boule called Crater, vas and patera, and alſo the Crowes head.

Item.

Item the hinder part of Centaurus, in euery part whereof are diuers Starres without name.

The Southerne Images contained in the ſeuenth ſpace.

FIrſt the left wing of the ſigne Virgo and her left hand, holding an eare of wheat, whereon is a Starre of the firſt bignes, called Spica Virginis, Stachis, Acimon, Alacel, and Azimech.

Item the Crowe called Coruus and Corax, his head and necke excepted, in whoſe left wing is a ſtarre of the fourth bigneſſe called Algorab.

Item the reſt of Hydrus, whereon the Crow ſtandeth, containing three ſtarres without name.

Item the reſt of Centaurus or Chiron with his boteſtaffe trimmed with boughes, his right hand and right foote excepted.

The Southerne Images contained in the eight ſpace.

THe whole Image of Libra, the ring onely excepted.

Item the fore part of Scorpio, whoſe fore cleas do lie vpon the two ballances, that is to ſay, his right clea vpon the North ballance, and his left clea vpon the South ballance, hauing vpon each clea a ſtarre of the ſecond bignes.

Item part of the Serpent called Anguis or Ophis, hauing one Starre of the fourth bignes.

Item the left hand of Serpentarius, holding part of the Serpent, vpon which hand are two ſtarres of the third bigneſſe called Yedd.

Item vpon the head of Scorpio are 3. ſtars of the third bignes, ſtanding all in a row and diuers others as well vpon his backe as vpon his left little clea without name.

Item the whole Wolfe called Fera, Lupus and Therion.

Item the right hand of Centaurus holding the ſaid Wolfe by the belly in both which are diuers ſtarres without name.

Item the right foote of Centaurus, in which is a faire ſtarre of the firſt bignes, and is called by the name of Centaurus.